



Falcon

iSCSI to SAS / SATA RAID Subsystem

Installation and Hardware Reference Manual

Version 1.1 (May 15, 08)

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This equipment is intended to be installed in a RESTRICTED ACCESS LOCATION only.



Electric Shock Warning!

To Prevent Electric Shock:

Access to this equipment is granted only to trained operators and service personnel who have been instructed of and fully understand the possible hazardous conditions and the consequences of accessing non-field-serviceable units. For example, touching the backplane with a metal tool may cause electric shock.

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FCC Class A Radio Frequency Interference Statement

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device may accept any interference received, including interference that may cause undesired operation.

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This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

WARNING:

A shielded power cord is required in order to meet FCC emission limits and also to prevent interference to nearby radio and television reception.

Use only shielded cables to connect I/O devices to this equipment. You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.



This device is in conformity with the EMC.

(Certified Worldwide)

This device meets the requirements of the CB standard for electrical equipment with regard to establishing a satisfactory level of safety for persons using the device and for the area surrounding the apparatus. This standard covers only safety aspects of the above apparatus; it does not cover other matters, such as style or performance.



For Power Supplies' compatibility to China Compulsory Certification.

In Compliance with AeA China RoHS Regulations (SJ/T 11364-2006)

有毒有害物质或元素的名称及含量

部件名称	有毒有害物质或元素					
	铅(Pb)	汞(Hg)	镉(Cd)	六价铬(Cr6+)	多溴联苯(PBB)	多溴二苯醚(PBDE)
PCBA	X	○	○	○	○	○
机壳机架	X	○	○	○	○	○

○:表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T 11363-2006规定的限量要求以下。
X:表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T 11363-2006规定的限量要求。

说明：

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1. 主动(半导体)组件：高熔点焊料合金中含有铅
2. 被动组件：电子陶瓷组件含有铅
3. 组件脚(脚距小于0.65mm之主、被动组件及连接器)含有铅
4. LCD模块所使用的光学玻璃含有铅

于机壳机架部分：

机壳机架中的铜合金、铝合金及铜合金含有铅

* 上述项目皆碍于技术上不够成熟、经济上及可靠度上不可行而含有过量有毒物质



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TE BSMI Class A, CNS 13438 (for Taiwan)
這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。



This device is in conformity with UL standards for safety.



Инструкция по безопасности

Модель:

iSCSI to SAS/SATA 3U/16Bay RAID Subsystem, Models
ESiSCSIR1130xxxxxx, ESFALCON iSCSIxxxx, where "x" can be "0-9", "A-Z",
blank, or dash "-" for marketing purpose and no impact safety related critical
components and constructions.

1. Перед использованием оборудования внимательно прочтите инструкцию.
2. Сохраняйте инструкцию для дальнейшего использования в работе.
3. Не допускайте попадания влаги на изделие.
4. Устанавливайте оборудование на устойчивую поверхность.
Падение может нанести ущерб оборудованию.
5. Соблюдайте климатические требования, использование
оборудование при температуре окружающей среды выше 50°C,
может привести к выходу оборудования из строя.
6. Размещайте шнур питания в недоступном для пользователя месте.
Запрещается ставить на шнур питания какие-либо предметы.
7. При работе с оборудованием необходимо учитывать все
предупреждения и замечания.
8. Если оборудование не используется в течении длительного времени,
отключите его от сети питания.
9. Запрещается вскрывать оборудование. Оборудование может
вскрываться только квалифицированным персоналом.
10. При возникновении одного из повреждений оборудования вызовите
обслуживающий персонал:
 - a. Повреждение шнура питания или вилки.
 - b. Оборудование не работает или его работа не соответствует
инструкции пользователя .
 - e. Оборудование повреждено.
 - f. Оборудование имеет очевидный признак поломки.
11. Источник питания должен быть установлен в соответствии с
инструкцией. Ток нагрузки и выходная мощность не должны
превышать указанных в спецификации.



RAID is committed to being properly prepared and taking all the necessary steps that will result in our compliance with the new European directive, RoHS (2002/95/EC), on or before the specific dates set forth in those applicable laws and regulations. RAID is applying its own internal efforts and expertise and is working closely with customers and suppliers to achieve compliance while maintaining an uninterrupted supply of quality products. RAID is currently investigating, evaluating, and qualifying our materials and components to ensure that products sold on or after 1 July 2006, in such territory, are in compliance with the above regulations.



Disposal of Old Electrical & Electronic Equipment (Applicable in the European Union and other European countries with separate collection systems)

This symbol on the product or on its packaging indicates that this product shall not be treated as household waste. Instead it shall be handed over to the applicable collection point for the recycling of electrical and electronic equipment. By proper waste handling of this product you ensure that it has no negative consequences for the environment and human health, which could otherwise be caused if this product is thrown into the garbage bin. The recycling of materials will help to conserve natural resources.

For more details about recycling of this product, please contact your local city office, your household waste disposal service or the shop where you purchased the product.

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Safety Precautions

Precautions and Instructions

- Prior to powering on the subsystem, ensure that the correct power range is being used.
- If it is necessary to transport the subsystem, repackage all disk drives separately in the drive trays and in the original package foam blocks. If using the original package material, other replaceable modules can stay within the enclosure.
- The Falcon subsystem comes with 16 drive bays. Leaving any of these drive bays empty will greatly affect the efficiency of the airflow within the enclosure, and will consequently lead to the system overheating, which can cause irreparable damage.
- If a module fails, leave it in place until you have a replacement unit and you are ready to replace it.
- Airflow Consideration: The subsystem requires an airflow clearance, especially at the front and rear. A clearance of at least 18 to 20 centimeters is required at the rear side and any objects blocking the exhaust airflow, e.g., cables dangling at the fan outlet, should be avoided.
- Handle subsystem modules using the retention screws, eject levers, and the metal frames/face plates. Avoid touching PCB boards and connector pins.
- To comply with safety, emission, or thermal requirements, none of the covers or replaceable modules should be removed. Make sure that all enclosure modules and covers are securely in place during operation.
- Be sure that the rack cabinet into which the subsystem chassis will be installed provides sufficient ventilation channels and airflow circulation around the subsystem.
- Provide a soft, clean surface to place your subsystem on before working on it. Servicing on a rough surface may damage the exterior of the chassis.
- If it is necessary to transport the subsystem, repackage all drives separately.
- Dual-redundant controller models come with two RAID controllers that should always be present. Single-controller models come with a single RAID controller and a metal sheet is placed over the lower controller bay at the rear of the subsystem. Since single-controller models cannot be upgraded, this metal sheet should NEVER be removed.

ESD Precautions

Observe all conventional anti-ESD methods while handling system modules. The use of a grounded wrist strap and an anti-static work pad are recommended. Avoid dust and debris in your work area.

About This Manual

This manual:

- f Introduces the Falcon iSCSI Subsystem series.
- f Describes all the active components in the system.
- f Provides recommendations and details about the hardware installation process of the subsystem.
- f Briefly describes how to monitor the subsystem.
- f Describes how to maintain the subsystem.

This manual does not:

- f Describe components that are not user-serviceable.
- f Give a detailed description of the RAID processing units or the RAID controllers within the subsystem.

Revision History

Rev. 1.0: Initial release.

Rev. 1.1: Added Russia GOST-R conformity statement.

Removed Appendix B Spare Parts and Accessories.
Related information can be found at RAID's website.

Who should read this manual?

This manual assumes that its readers are experienced with computer hardware installation and are familiar with storage enclosures.

Related Documentation

- Generic Operation Manual (firmware operation via LCD keypad or terminal emulation)
- StorageWatch User's Manual

These two (2) documents are included in the product utility CD that came with your subsystem package.

Conventions

Naming

From this point on and throughout the rest of this manual, the Falcon series is referred to as simply the “subsystem” or the “system”



Important Messages

Important messages appear where mishandling of components is possible or when work order can be mis-conceived. These messages also provide important information associated with other aspects of system operation. The word “important” is written as **IMPORTANT**, both capitalized and bold and is followed by text in italics. The italicized text is the message to be delivered.



Warnings

Warnings appear where overlooked details may cause damage to the equipment or result in personal injury. Warnings should be taken seriously. Warnings are easy to recognize. The word “warning” is written as **WARNING**, both capitalized and bold and is followed by text in italics. The italicized text is the warning message.



Cautions

Cautionary messages should also be heeded to help you reduce the chance of losing data or damaging the system. Cautions are easy to recognize. The word “caution” is written as **CAUTION**, both capitalized and bold and is followed by text in italics. The italicized text is the cautionary message.



Notes

These messages inform the reader of essential but non-critical information. These messages should be read carefully as any

directions or instructions contained therein can help you avoid making mistakes. Notes are easy to recognize. The word “note” is written as “**NOTE**,” both capitalized and bold and is followed by text in italics. The italicized text is the cautionary message.

Lists

Bulleted Lists: Bulleted lists are statements of non-sequential facts. They can be read in any order. Each statement is preceded by a round black dot “•.”

Numbered Lists: Numbered lists are used to describe sequential steps you should follow in order.

Software and Firmware Updates

Please contact RAID or visit the RAID Inc. support site at www.raidinc.com/support.php for the latest software or firmware updates. **NOTE** that the firmware version installed on your system should provide the complete functionality listed in the specification sheet/user's manual. We provide special revisions for various application purposes. Therefore, DO NOT upgrade your firmware unless you fully understand what a firmware revision will do.

Problems that occur during the updating process may cause irrecoverable errors and system down time. Always consult technical personnel before proceeding with any firmware upgrade.

Chapter 1

Introduction

1.1 Product Overview

1.1.1 Introduction

This chapter briefly introduces the Falcon iSCSI-to-SAS/SATA-II storage subsystem. The iSCSI subsystem comes with four (4) Gigabit Ethernet host ports on each RAID controller and delivers fast I/O performance over iSCSI packets.

RAID's Falcon storage supports network initiators compatible with the IETF (Internet Storage Name Server) iSCSI standard (RFC 3720) with the following functionality:



Figure 1-1: Falcon iSCSI Subsystem

- f Access control via NetMask, IQN, and IP filtering
- f iSNS & SLP device discovery (firmware rev. 3.64)
- f CHAP access control security
- f Jumbo frames
- f Header Digest mode (for the redundant-controller R1130)

Internet SCSI (iSCSI) protocols are embedded in firmware and I/Os are rapidly processed via dedicated algorithms. The iSCSI is built around reliable hardware and sophisticated RAID technologies. I/O requests are packaged and transmitted over local area networks (LANs), wide area networks (WANs), or the Internet using the existing Ethernet network and thus the total cost of ownership is reduced. With the help of the networking flexibility, the subsystem is ideal for location-independent data storage, backup, and retrieval.

The subsystem delivers extreme performance that results from the combined performance of multiple disk drives and the level of data protection unseen in other iSCSI storages. Featuring all standard RAID functionality as other Falcon subsystems, the iSCSI subsystem provides a reliable platform for IT operations such as backup, data-mining, or strategic data allocation.

This subsystem features a high-density architecture that supports up to sixteen (16) hot swappable, SAS or SATA-II hard drives. The subsystem is powered by active-active or a single RAID controller featuring the latest ASIC400, RAID6 ASIC as the RAID engine. The pre-installed 512MB DDR RAM DIMM module can be upgraded to a 2GB capacity DIMM to support complicated applications that hold numerous ID/LUN combinations.

In addition to the ease of implementation, the Falcon also supports capacity expansion via its SAS links by attaching JBODs. If using 1TB size SATA drives in a combination of single- controller RAID and JBOD, a configuration can reach a maximum capacity of 80TB.

The FALCON iSCSI features high-availability design with dual-active RAID controllers. Dual-redundant, hot-swappable cooling modules, battery backup, and power supplies ensures the optimal up time. The modular nature of the subsystem and the easy accessibility to all components ensure the ease of maintenance.

**NOTE:**

On receiving and unpacking your subsystem, please check the package contents against the included **Unpacking Checklist**. If any modules are missing, please contact your vendor immediately.

Model Variations

- f **FALCON iSCSI (Dual):** This model comes with redundant RAID controllers. The dual-controller configuration corresponds with SAS drives' dual-ported design and each manages a separate SAS domain for higher fault tolerance. The dual-controller model supports all necessary features such as synchronized cache and the transparent failover/failback capability.
- f **FALCON iSCSI (Single):** This model comes with one (1) RAID controller. This model cannot be upgraded into a dual-redundant configuration by adding a partner RAID controller. Except for controller redundancy, the single-controller configuration supports all advanced RAID technologies and fault tolerance by redundant pairs of other modules.

1.1.2 Enclosure Chassis

1.1.2.1 Chassis Overview

The Falcon iSCSI RAID storage is housed in a 3U robust chassis that is divided into the front and the rear sections. Key components are respectively accessed through the front (see **Figure 1-2**) and rear panels. The enclosure chassis can be mounted into a standard 19-inch rack or enclosure cabinet using support brackets that are separately-purchased.



NOTE:

Components accessed through the front panel are referred to as “**Front Panel Components**” and components accessed through the rear panel are referred to as “**Rear Panel Components.**”

1.1.2.2 Physical Dimensions

The iSCSI comes in a 3U chassis with the following dimensions:

- f With handles: 483mm (W) x 131mm (H) x 504.3mm (L) (19 x 5.2 x 21 inches)
- f Without handles: 445mm x 130mm x 487mm (17.5 x 5.1 x 19.2 inches)

1.1.2.3 Front Panel Overview

The front section of the subsystem features a 4x4 layout for sixteen (16) 3.5-inch disk drives. The two (2) handles on the front of the subsystem enable you to easily extract the chassis from a rack or cabinet. The front view is shown below. A description of each front panel component is given below:

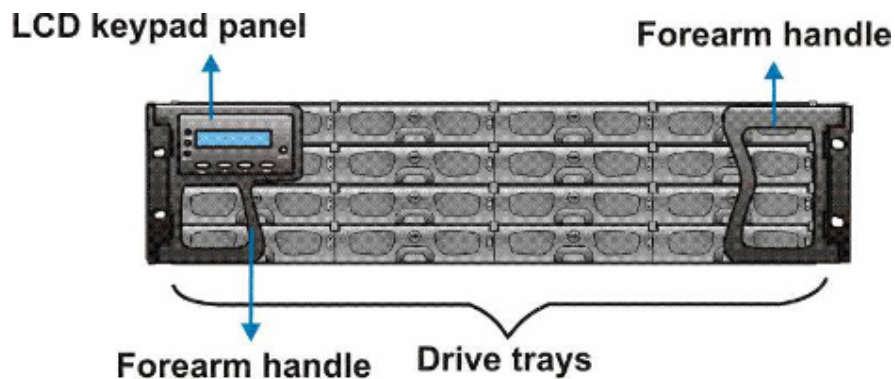


Figure 1-2: iSCSI Front View

The front panel components include:

- **Drive bays with drive tray canisters:** The drive bays accommodate either SAS or SATA-II 3.5" disk drives.
- **Forearm handles:** The subsystem has right- and left-side handles for easier rackmount handling.

1.1.2.4 Hard Drive Numbering

The front section of the iSCSI enclosure houses sixteen (16) hard drives in a 4x4 configuration. When viewed from the front, the drive bays (slots) are numbered 1 to 16 from left to right and then from top to bottom.

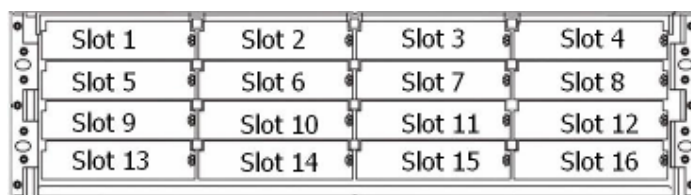


Figure 1-3: Hard Drive Numbering

1.1.2.5 Rear Panel Overview

The rear section of the subsystem is accessed through the rear panel and is reserved for a single RAID controller module, one (1) optional BBU, two (2) power supply units (PSUs), and two (2) cooling modules.

A rear view of the subsystem is shown below. Descriptions of each rear panel component are given in the following sections:

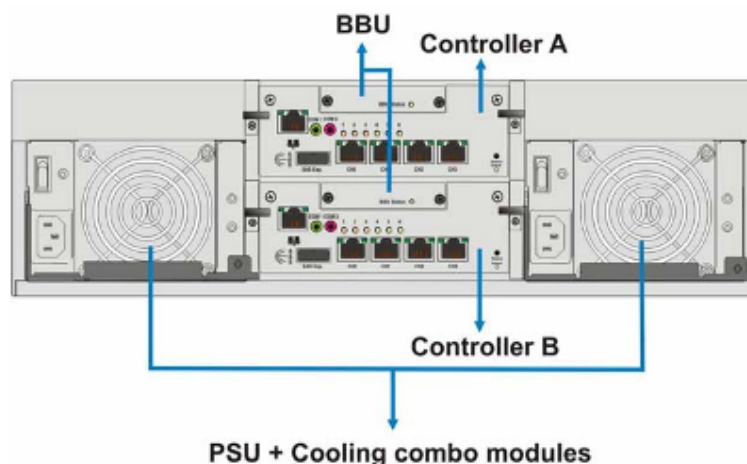


Figure 1-4: FALCON iSCSI Rear View

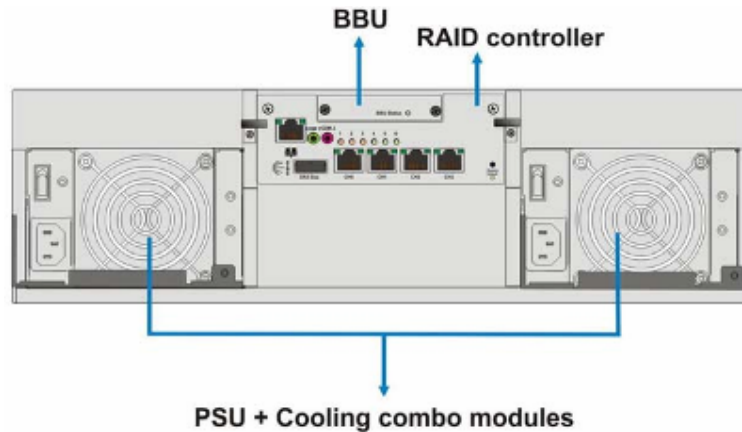


Figure 1-5: FALCON iSCSI Rear View

The enclosure rear section accommodates the following components:

- **RAID controller module(s):** The RAID controller module manages all functionalities provided with the subsystem, and all interface connectors are provided on the controller faceplates. (See **Section 1.2.3**)
- **BBU module:** BBU modules come as standard equipment for the redundant-controller model, and as an optional module for the single-controller Single Cont.. The BBU sustains unfinished writes cached in memory during a power outage in order to prevent data loss. (See **Section 1.2.6**)
- **PSU modules:** The hot-swappable PSUs receive single-phase power and deliver +5V, +12V, and +3.3V power to the subsystem. A power switch is located on each PSU to turn the system on and off. (See **Section 1.2.7**)
- **Cooling modules:** The redundant cooling modules ventilate the subsystem to maintain a cooling airflow across the subsystem. (See **Section 1.2.8**)

1.1.2.6 Backplane Board

An internal backplane board separates the front and rear sections of the enclosure. The backplane consists of traces for logic level signals and low voltage power paths. It contains no user-serviceable components.



WARNING!

When inserting a removable module, **DO NOT USE EXCESSIVE FORCE!** Forcing or slamming a module can damage the pins on the module connectors either on the module itself or on the backplane. Gently push the module until it reaches the end of module slot. Feel the contact resistance and use slightly more

pressure to ensure the module connectors are correctly mated. If the module comes with ejection levers or retention screws, use them to secure the module.

1.2 Subsystem Components

The iSCSI houses many active components and most of them can be accessed through either the front or the rear panel. The modular design of the components facilitates their easy installation and removal. Hot-swap mechanisms are incorporated to eliminate power surges and signal glitches that might occur while removing or installing these modules.

1.2.1 Drive Trays

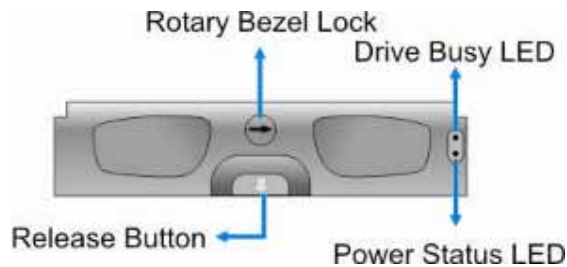


Figure 1-6: Drive Tray Front View

PN: IFT-9273CDTray



Figure 1-7: IFT-9273CETray

PN: IFT-9273CETray (adapter tray for 2.5" SAS drives)

The subsystem comes with sixteen (16) drive trays (see **Figure 1-6**) designed to accommodate separately purchased, standard 1-inch pitch, 3.5-inch SAS or SATA-II disk drives. The drive bays are accessible from the enclosure front panel. Two (2) LEDs on the front bezel indicate the operating statuses. A rotary bezel lock on each drive tray secures the hard drive in place, while a release button enables fast retrieval of a hard drive.

You may install 2.5" SAS drives into the subsystem for its high IOPS performance. The 2.5" drives are secured through holes on the bottom of the drive trays. The installation and use of the adapter drive trays is identical to those using 3.5" drives.



WARNING!

Be careful not to warp, twist, or contort the drive tray in any way (e.g., by dropping it or resting heavy objects on it). The drive tray has been customized to fit into the drive bays of the subsystem. If the drive bay superstructure is deformed or altered, the drive trays may not fit into the drive bays.

1.2.2 MUX Kit

Unlike the dual-ported SAS drives, using the single-port SATA drives with a redundant-controller RAID requires a MUX board.

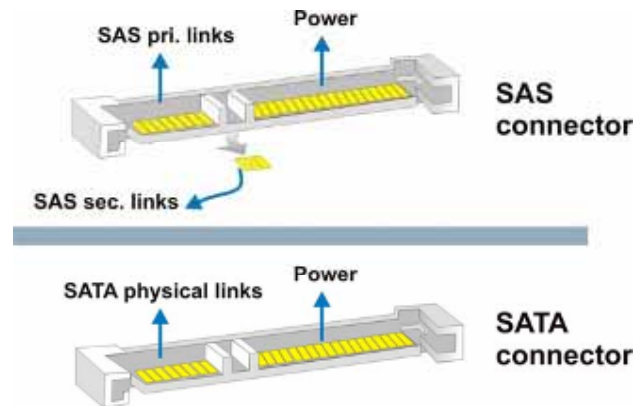


Figure 1-8: Dual-ported SAS and Single-port SAS Connectors

The MUX board provides port selector circuits for access from different RAID controllers to an individual disk drive. See the drawing below for how it works.

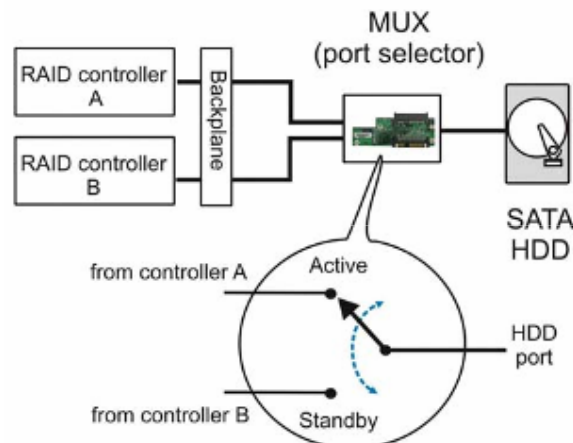


Figure 1-9: MUX Kit Working Theory

If SAS drives are preferred, these MUX boards will be unnecessary and must be manually removed from the drive trays by loosening 3 retention screws.

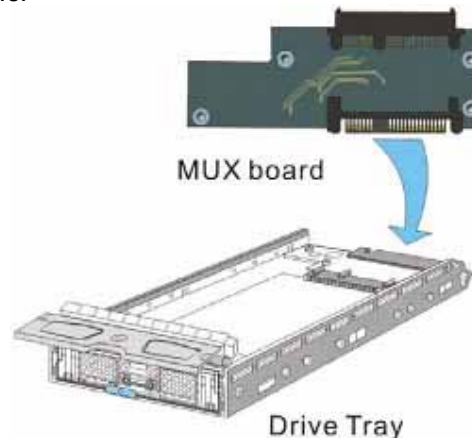


Figure 1-10: MUX Kit

1.2.3 The RAID Controller Module

PN:	IFT-83SE11RE16 (without DDR RAM)	FALCON iSCSI
	IFT-83SE11RE16M5 (with 512MB DDR RAM)	
	IFT-83SE11GE16 (without DDR RAM)	FALCON iSCSI
	IFT-83SE11GE16M5 (with 512MB DDR RAM)	

The default size for the DDR DIMM module on RAID controllers is 512MB. RAID controller module contains a main circuit board, a preinstalled 512MB capacity or above, charger circuitry, and a daughter board with management interfaces. The controller module contains no user-serviceable components. Except when installing/upgrading the cache memory inside, the controller module should never be removed or opened.



WARNING!

Although the RAID controller can be removed, the only time you should touch the controller itself is to install the memory modules. The RAID controller is built of sensitive components and unnecessary tampering can damage the controller.

The iSCSI system is managed by the RAID controller(s). The controller comes with four (4) GbE Ethernet host ports. The subsystem connects to the host through RJ-45 connectors, while the connectors are also ready to connect to one or more network

switches, enabling access to your storage volumes in complex configurations such as data-sharing or Virtual LAN segments.

The docking connector at the rear of the controller board connects the controller module to the backplane board.

1.2.4 Controller Module Interfaces

All external interfaces that connect to external devices are located on the controller module's rear-facing faceplate. The interfaces are listed below.

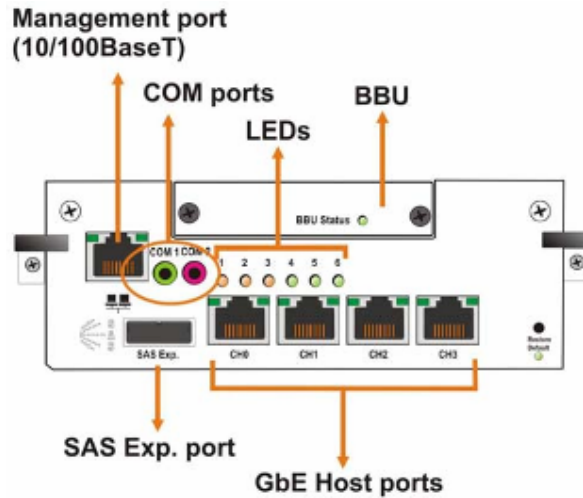


Figure 1-11: Controller Module Interfaces

- f **Host ports:** Four (4) Gigabit Ethernet host ports (indicated as CH0 to CH3 in the diagram shown above) connect the Falcon subsystem to the networked iSCSI initiators through RJ-45 connectors.
- f **COM port:** The controller module comes with two (2) COM ports. The serial ports are used for local access to the firmware embedded configuration utility and the connection to a UPS device.
- f **LED indicators:** Six (6) LED indicators illustrate the system statuses for system monitoring. Please see **Chapter 3** for more information.
- f **Ejection Levers:** Two (2) ejection levers located on the sides of the controller ensure that the back-end connectors are properly seated in the module slot and properly mated with the backplane.
- f **Management LAN Port:** Another 10/100BaseT Ethernet port connects the subsystem to a management computer. Available management interfaces include: telnet, Java-based

StorageWatch manager, or the web-based “Embedded RAIDWatch” manager invoked by an http console.

- f **Restore Default LED and button:** The push button and LED are used to restore firmware defaults in cases when upgrading firmware, upgrading DIMM size, or if an administrator forgets system password. For more details, please refer to **Chapter 3**.

1.2.5 DIMM Module

The controller module comes with a preinstalled 512MB capacity or above DDR RAM DIMM module and the allocable size can reach 2GB. The memory socket is located on the side of the controller board.

1.2.6 BBU

PN: IFT-9273CBT (default)
IFT-9273CBTE (larger capacity)

An optional, separately purchased Li-Ion battery backup unit (BBU) module (see the diagram below) can sustain cache memory for days during the event of power outage. The battery module comes with an EEPROM that marks the installation date, and system administrators will be notified when the one-year life expectancy is reached. Please refer to **Chapter 2** for installation instructions.

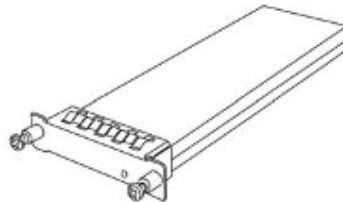


Figure 1-12: BBU Module

In accordance with international transportation regulations, the BBU module is only charged to between 35% and 45% of its total capacity when shipped. Therefore, when powering on the subsystem for the first time (see **Section 4.4**) the BBU will begin to charge its batteries to their full capacity. It normally requires approximately twelve (12) hours for the battery to be fully charged. If the battery is not fully charged after twelve (12) hours, there may be a problem with the BBU module. You may re-install the battery; and if the battery still shows problems with charging, contact your subsystem vendor for a replacement. While the battery is being charged, the LED on the BBU will start flashing. (See **Chapter 3** for details on the LED indicators.)

You can check battery's charge level using the StorageWatch software or the embedded firmware utility.

1.2.7 Power Supply Units

PN: IFT-9273ECPSU

The subsystem is equipped with two (2) redundant, hot-swappable, 530W PSUs, which are installed into the rear section of the chassis. The PSU is permanently mounted into a 2U (dual-level) canister especially designed to house both the PSU and a cooling module at the end of the 2U canister.



NOTE:

Swapping the PSU also removes the cooling module within.

As shown in **Figure 1-13**, each PSU comes with a power socket and a power switch to turn the system on and off. Two (2) embedded cooling fans provide sufficient airflow. A single LED indicates the PSU status. When a power supply failure occurs, the LED lights red. An extraction handle at the rear of the PSU is designed to help properly install or remove the module.

A screw hole on the ejection handle helps secure the PSU to the chassis.

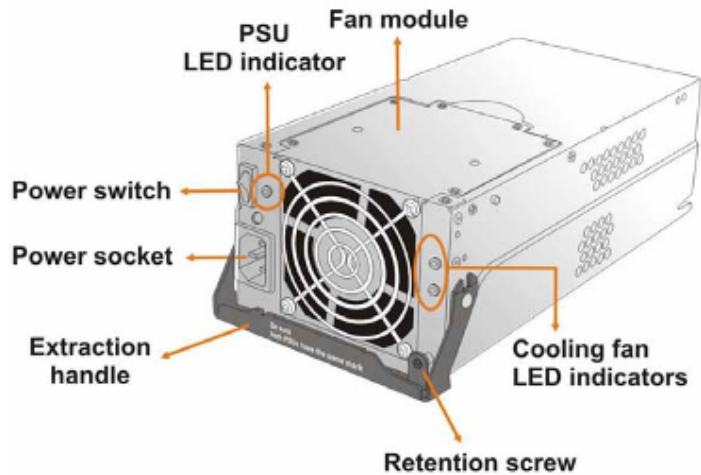


Figure 1-13: PSU Module

Please refer to **Appendix A** for the technical information of the PSUs.

1.2.8 Cooling Modules

PN: IFT-9273ECFanMod

Two cooling modules are implemented within the rear sections of PSU modules. (see **Figure 1-14**.) The cooling fans operate at two (2)

fan speeds. When the subsystem operates normally, the cooling fans operate at the lower speed. If a major component fails or when one of the temperature thresholds is violated, the cooling fans automatically raise its rotation speed.

More technical information can be found in **Appendix A**.

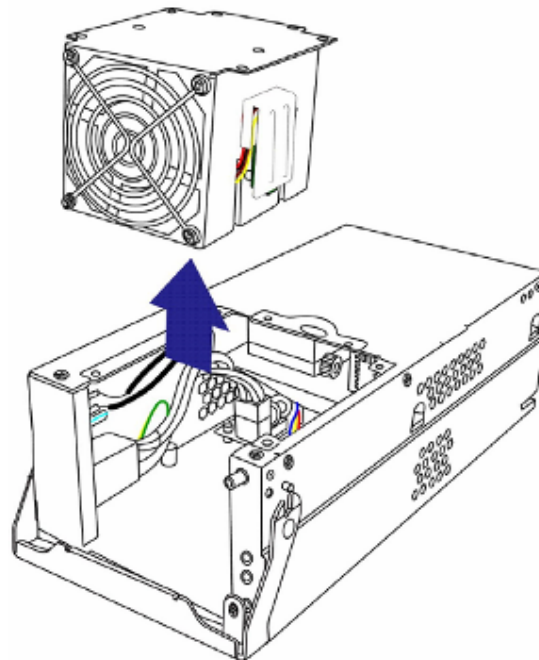


Figure 1-14: Cooling Module

1.3 Subsystem Monitoring

The iSCSI RAID subsystem comes with a number of different monitoring methods that provide you with continual updates on the operating statuses of the subsystem and individual components. The following monitoring features are included:

1.3.1 I²C bus

The following subsystem elements are interfaced to the RAID controller over a non-user-serviceable I²C bus:

- ƒ Cooling modules
- ƒ Module presence detection circuits
- ƒ Temperature sensors (for detecting the temperature on the backplane board and controller board)

1.3.2 LED Indicators

The following components come with LEDs to indicate the operating statuses of individual components:

- ƒ RAID controller
- ƒ BBU module
- ƒ Cooling modules (on PSU faceplates)
- ƒ PSU modules (1 LED on each module)
- ƒ Drive trays (2 LEDs on each tray)

1.3.3 Audible Alarms

The subsystem comes with an audible alarm that is triggered when a component fails or when the pre-configured temperature or voltage thresholds are exceeded. Whenever you hear an audible alarm, it is imperative that you determine the cause and rectify the problem immediately.

Event notification messages indicate the completion or status of array configuration tasks and are always accompanied by two (2) or three (3) successive and prolonged beeps.



WARNING!

Failing to respond when an audible alarm is heard can cause permanent damage to the subsystem. When an audible alarm is heard, rectify the problem as soon as possible.

1.4 Hot-swappable Components

1.4.1 Hot-swap Capabilities

The subsystem comes with a number of hot-swappable components. A hot-swap component is one that can be exchanged while the subsystem is still online without affecting the operational integrity of the subsystem. These components should only be removed from the subsystem when they are being replaced. At no other time should these components be removed from the subsystem.

1.4.2 Components

The following components are hot-swappable:

- ƒ RAID controller (in a redundant-controller configuration)
- ƒ Power supply units (PSUs)
- ƒ BBU module
- ƒ Hard disk drives

1.4.3 Normalized Airflow

Proper cooling is referred to as “normalized” airflow. Normalized airflow ensures the sufficient cooling within the subsystem and is only attained when all components are properly installed. Therefore, a failed component should only be removed when a replacement is available. If a failed component is removed but not replaced, airflow will be disrupted and permanent damage to the subsystem can result.

Chapter 2

Hardware Installation

2.1 Introduction

This chapter gives detailed instructions on how to install the subsystem. When installing the subsystem, it is necessary to mount the chassis into a rack cabinet and to install hard drives and drive trays. Installation into a rack or cabinet should occur **before** the hard drives or drive trays are installed into the subsystem. Please confirm that you received all of the components listed on the included **Unpacking List** before proceeding with the installation process.

2.2 Installation Prerequisites

1. **Static-free installation environment:** The Falcon iSCSI subsystem must be installed in a static-free environment to minimize the possibility of electrostatic discharge (ESD) damage. (See **Section 2.3.2**)
2. **Component check:** Before installing the Falcon iSCSI subsystem, you should first check to see that you have received all the required components. (See **Section 2.5**) If any items appear damaged, contact your vendor for a replacement.
3. **Hard drives:** Up to sixteen (16) SATA-II hard drives must be purchased separately prior to installing the subsystem. (See **Section 2.8**)

4. **Cabling:**

The iSCSI models come with the following cables;

1. One (1) audio-jack-to-DB9 cable to facilitate the connection of the **COM1** serial port to a management computer for management over a terminal emulation program.
2. Two (2) **power cords** for connections to the power sources. Type is determined by the shipped-to area.

Other cables are user-supplied:

1. **Host link cables:** For the compliance with listed emission standard, RJ-45 STP cables should be applied. RAID provides certified cables as an optional accessory. One 3-meter STP Ethernet cable is available as an accessory option.
2. **COM2** serial cable for connecting UPS device.
3. One (1) or two (2) Ethernet cables to the 10/100BaseT **management port**.

Please see **Chapter 4** for sample topologies and configuration options and **Appendix B** for accessories.

5. **Memory module:** If you wish to change the pre-installed memory module, a separately purchased module can be installed. (See **Section 5.3**)
6. **BBU module:** The BBU module is optional for the single-controller FALCON iSCSI. the module can be purchased separately. For installation instructions, please see **Section 2.7**.
7. Mixing SAS and SATA drives in the same enclosure is allowed. However, please DO NOT mix SAS and SATA-II drives in the same drive column.
8. DO NOT place a column of SATA-II disk drives between two columns of SAS disk drives. With a higher rotation speed, the SAS disk drives on the flank of SATA-II disk drives will eventually cause a stability issue.

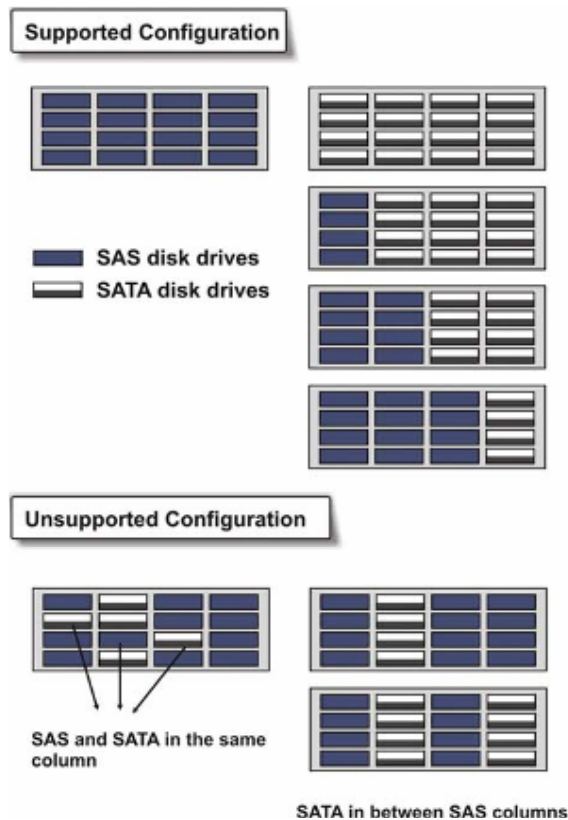


Figure 2-1: Supported and Unsupported Drive Configurations

9. **Hard drives:** Up to sixteen (16) SAS or SATA-II hard drives must be purchased separately and hard drives should be available prior to installing the enclosure. (See **Section 2.8**)



NOTE:

Some SATA-II disk drives may come with a default of 1.5Gbps speed. The system only supports SATA drives operating at 3Gbps speed, and it will be necessary you configure these drives into 3Gbps speed using its the jumpers or configuration utility.

2.3 Safety Precautions

2.3.1 Precautions and Instructions

1. **Static-free installation environment:** The enclosure must be installed in a static-free environment to minimize the possibility of electrostatic discharge (ESD) damage.

2. **Component check:** Before installing the enclosure, check to see that you have received all the required components. If any items appear damaged, contact your vendor for a replacement.
3. **Rack installation:** The enclosure chassis can be installed into a rack cabinet using separately purchased mounting rails, rear-attached brackets, or RAID's **IFT-9273Cslider32** and **IFT-9273CSlider36** rackmount rails.
4. Disconnect the power cords if the need should arise for cleaning the chassis. Do not use liquid or sprayed detergent for cleaning. Use a lightly moistened cloth for cleaning.
5. Be sure the correct power range (100-120 or 220-240VAC) is supplied by your rack cabinet or power outlet. It is highly recommended to connect two different power supplies to separate power sources; e.g., one to a power outlet, and the other to a UPS system.
6. Thermal notice: All drive trays (even if they do not contain a hard drive) must be installed into the enclosure. Leaving a drive bay or module slot open will severely affect the airflow efficiency within the enclosure, and will consequently lead to system overheating. Keep a faulty module in place until you have a replacement unit and you are ready to replace it.
7. Rack-mounting: The subsystem is intended to be rack-mounted. Following concerns should be heeded when mounting the enclosure into a rack cabinet:
 - a. An enclosure without disk drives can weigh over 30 kilograms. Two (2) people are required to install or relocate the subsystem. Drives should be removed from the enclosure before moving the subsystem.
 - b. The subsystem is designed to operate in an environment where the ambient temperature around the chassis must not exceed 40°C.
 - c. The openings on the enclosure are for air circulation and hence the ventilation openings should never be obstructed.
 - d. Proper grounding, over-current protection, and stability features should be provided with the rack cabinet into which the subsystem is mounted.
8. Operate the subsystem in an environment with least humidity.
9. Lay the subsystem on a reliable surface when servicing individual modules. A drop or fall can cause injury.

10. Make sure the voltage of the power source is within the rated values as indicated by the label attached to the power supplies before connecting the subsystem to the power source. You may also refer to the Appendix A of this manual for technical details.
11. Airflow considerations: The subsystem requires an airflow clearance especially on the front and the rear sides. For proper ventilation, a minimum of 2.5cm is required between the front of the enclosure and rack cover; a minimum of **18 to 20cm** is required on the rear side.
12. Handle the system modules by the retention screws, ejection levers, or the modules' metal frames/faceplates only. Avoid touching the PCB boards and connector pins.
13. None of the covers or replaceable modules should be removed in order to maintain compliance with safety, emission, or thermal requirements.
14. If the subsystem is going to be left unused for a long time, disconnect the subsystem from mains to avoid damages by transient over-voltage.
15. Never pour any liquid into ventilation openings; this could cause fire or electrical shock.
16. Never open the subsystem top cover. For safety reasons, only qualified service personnel could access the interior of the chassis.
17. Always secure every enclosure module by its retaining screws or make sure it is held in place by its latches or hand screws.
18. Always make sure the subsystem has a safe electrical earth connection via power cords or chassis ground by the rack cabinet.
19. Be sure that the rack cabinet in which the subsystem chassis is to be installed provides sufficient ventilation channels and airflow circulation around the subsystem.
20. Provide a soft, clean surface to place your enclosure on before working on it. Servicing the enclosure on a rough surface may damage the finish of the chassis.
21. If it is necessary to transport the subsystem, repackage all disk drives separately.
22. If one of the following situations arises, get the enclosure checked by service personnel:
 - a. Any of the power cords or plugs is damaged.

- b. Liquid has penetrated into the subsystem.
- c. The enclosure has been exposed to moisture.
- d. The subsystem does not work well or you cannot get it work according to this manual.
- e. The subsystem has dropped and been damaged.
- f. The subsystem shows obvious signs of breakage.

2.3.2 Static-free Installation

Static electricity can damage the system's electronic components. To prevent ESD damage to any of the components, follow these precautions before touching or handling them:

- f Discharge the static electricity accumulated in your body by wearing an anti-static wristband.
- f Use antistatic strap during handling. Connect the equipment end of the strap to an unfinished chassis surface.
- f Avoid carpets, plastic, vinyl, and styrofoam in your work area.
- f If the need should arise for carrying subsystem modules from one place to another, carry them in a static shielding container.
- f Avoid the contact between circuit boards and clothing.
- f Handle all components by holding their edges or metal frames. Avoid touching the exposed circuitry on PCB boards and connector pins.

2.4 General Installation Procedure

Following all the instructions provided below can save subsystem installation time. Detailed, illustrated instructions for each component are given in the following sections.



CAUTION!

To ensure that your system is correctly installed, please follow the steps outlined below. If you follow these steps, installation will be fast and efficient. If you do not follow these steps, you may accidentally install the hardware incorrectly.

- Step 1.** **Unpack:** Unpack the subsystem and confirm that all the components on the **Unpacking Checklist** have been included.
- Step 2.** **Install an optional BBU:** If a BBU has been separately purchased, it should be installed prior to operating the subsystem. (See **Section 2.7**)
- Step 3.** **Rack/Cabinet installation:** If the subsystem is going to be installed in a rack or cabinet, it should be installed prior to installing the hard drives. Installing the subsystem into a rack or cabinet requires at least two (2) people. (See **Section 2.6**)
- Step 4.** **Install hard drives:** Separately purchased SATA-II/SATA-I hard drives must be individually installed into the drive trays. (See **Section 2.8**) 2.5" SAS hard drives are also applicable using the IFT-9273CDTray.
- Step 5.** **Install drive trays:** After the hard drives have been installed into the drive trays, the drive trays must be installed into the enclosure itself. (See **Section 2.9**)
- Step 6.** **Cable connection:** Use the power cords that came with the subsystem to connect the subsystem to the main power source. Use self-purchased RJ-45 cables (see **Chapter 4** for more details) to connect host ports to the network or external devices.
- Step 7.** **Power up:** Once the components have been properly installed and all cables are properly connected, you can power up the subsystem and configure the RAID array. (See **Section 4.4**)

Installation Procedure Flowchart

Figure 2-2 shows a flowchart of the installation procedure. As you complete each step, check off the **"Done"** box on the right. Please use this flowchart in conjunction with the instructions that follow.

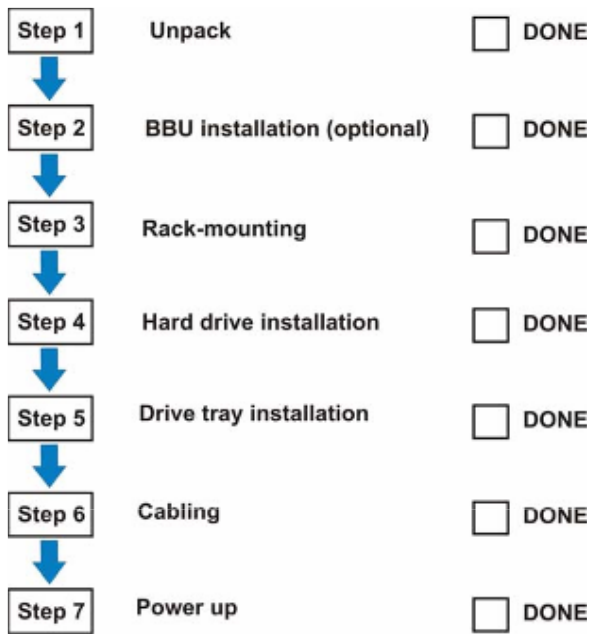


Figure 2-2: Installation Procedure Flowchart

2.5 Unpacking the Subsystem

Use the **Unpacking Checklist** in your package to verify package contents. Carefully check the items contained in each box before proceeding with installation.



NOTE:

A detailed packing list can be found in your product shipping package or product CD.

The space within each package carton can be separated into upper and lower levels.

Upper level: The two (2) foam packages on the upper level contain:

- Sixteen (16) drive trays

Lower level: Three (3) boxes are placed in the lower level. One (1) box contains the enclosure chassis with all the pre-installed components. The other two (2) boxes contain power cords and accessory items.

The included accessory items are:

1. A COM1 serial cable.
2. Two power cords.
3. A null modem.

4. Printed copies of **Quick Installation Guide** and Unpacking checklist.
5. Screws for rack-mounting and fixing disk drives.
6. A product utility CD containing the **Installation and Hardware Reference Manual** (this document), the **Operation Manual** (firmware), and the StorageWatch programs and **StorageWatch User's Manual**.

2.5.1 Preinstalled Components

The following components have been preinstalled in the enclosure and therefore do not need to be installed:

- f 2 - Forearm handles (right and left)
- f 1 - Backplane board
- f 1 - Controller module
- f 1 - DDR RAM DIMM module (installed in the controller module)
- f 2 - PSU modules
- f 2 - BBU (for the redundant-controller R1130)
- f 1 - LCD keypad panel
- f 2 - Cooling fan modules (within PSU canisters)

2.5.2 Components to be Installed

You must install the following components:

- f Rackmount rails (if purchased)
- f Hard drives (separately purchased SAS or SATA-II disk drives)
- f Drive trays
- f BBU module (if ordered)

2.6 Rack/Cabinet Installation

PN: IFT-9273CSlide32 - for 23" to 32" deep rack

PN: IFT-9273CSlide36 - for 23" to 36" deep rack

The subsystem is designed to fit into a variety of 19-inch rack cabinets or racks. Make sure you have an appropriate site location and cables prepared with adequate lengths to connect to mains and other devices.

The subsystem should be installed in the rack or cabinet before the hard drives and the drive trays are installed. If the drive trays with the associated hard drives are installed, the subsystem will be too heavy to mount into a rack or cabinet. When installing the subsystem into a

rack or cabinet it is advisable that two (2) people assist in the mounting process.

Package Contents

The rackmount rail kits includes the following components. Be sure to confirm that you have received each item listed below:

Item	Description	Quantity
1	Left-side L-shape rail	1
2	Right-side L-shape rail	1
3	Extension bracket	2
4	Filler plate	2
5	Left-side rear support	1
6	Right-side rear support	1
7	M5 clip nut	4
8	Position screw	8
9	#6-32 x 12mm flat head screw	10
10	M5 x 35mm screw	4

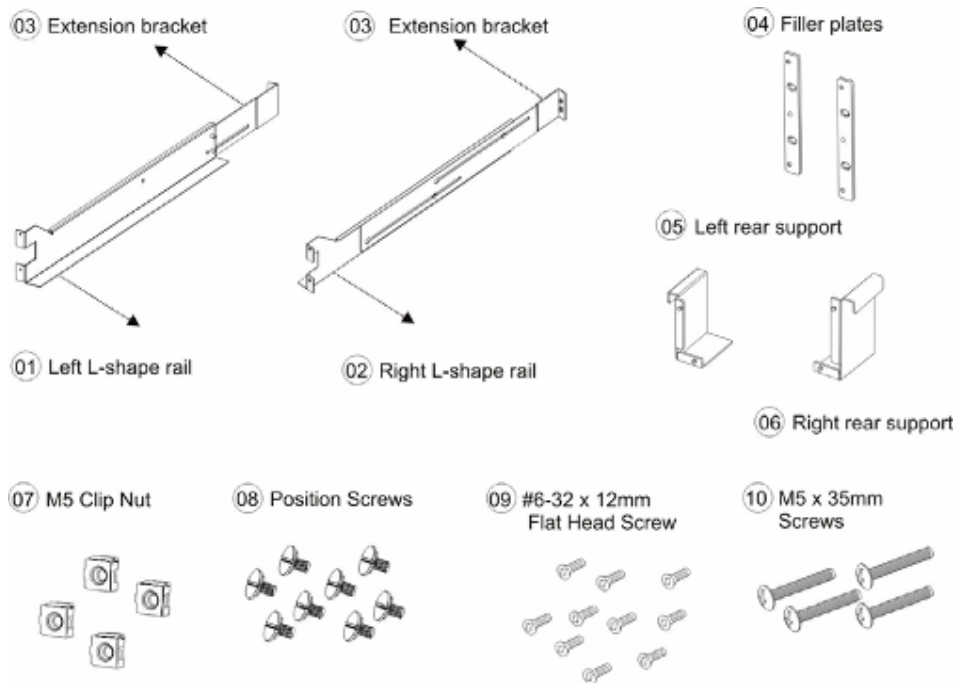


Figure 2-3: Rackmount Rail Components

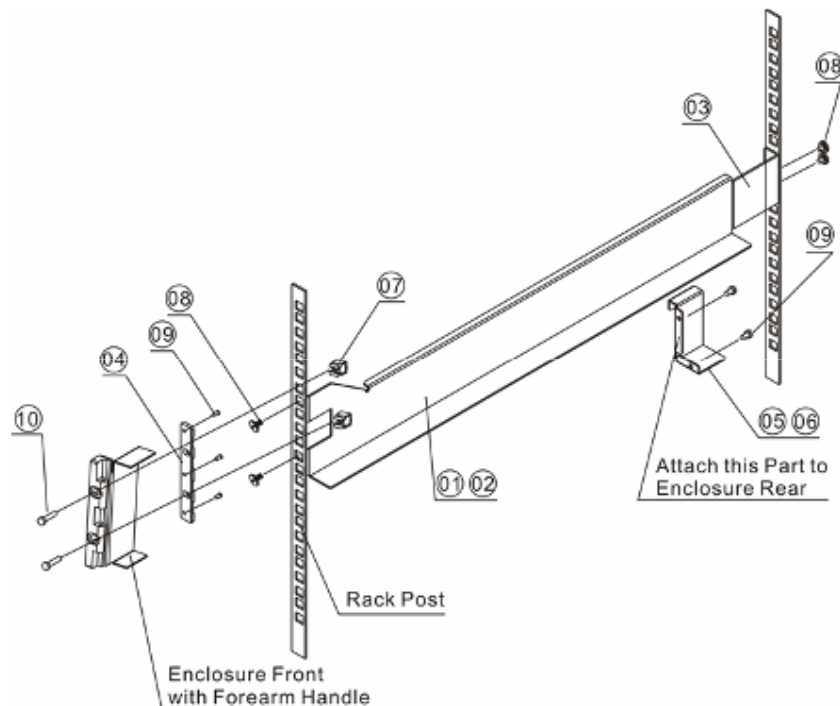


Figure 2-4: Rackmount Rail Assembly

Installation Pre-requisites

- 1 medium-size and 1 small-size cross-head screwdrivers
- 1 medium-size flat-head screwdriver
- Because the RAID subsystem can weigh over 28 kilograms, 2 people are required to rack-mount the enclosure.

Rack-mounting Steps

- Step 1.** Determine where in the rack, the subsystem is going to be installed.



CAUTION!

The mounting positions must be carefully measures so that rails can be mounted parallel to each other.

- Step 2.** Use the figure below to measure the relative locations of the cage nuts on the rack posts (if they do not have threaded holes). There are 5 holes between clip nuts. Attach two M5 clip nuts (#07) on each of the front rack posts.

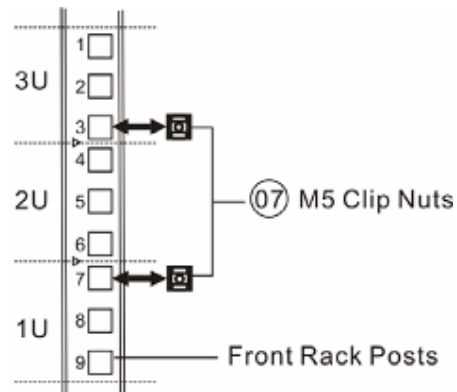


Figure 2-5: Attaching Cage Nuts to a Front Rack Post

- Step 3.** Adjust the length of the rail assembly and make sure the bend of the L-shape rail (#01) faces inward.

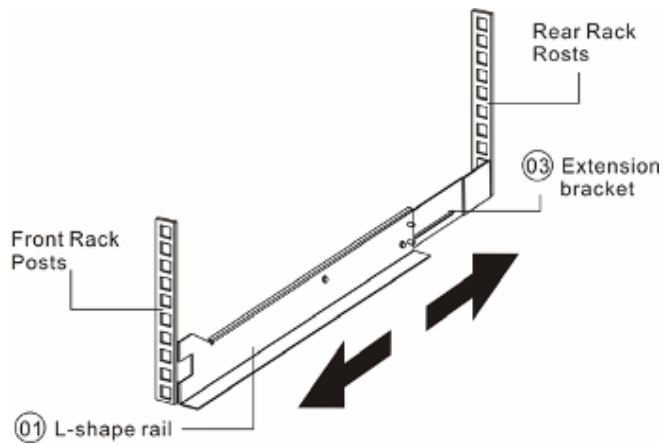


Figure 2-6: Fitting the Rail into Rack

- Step 4.** Position the front-end of a rail below the top clip nut. Secure the rail to the front and rear rack posts each using two position screws (#08). (See figure below) Do not insert the screws into the cage nuts as cage nuts will be used to secure the enclosure later.

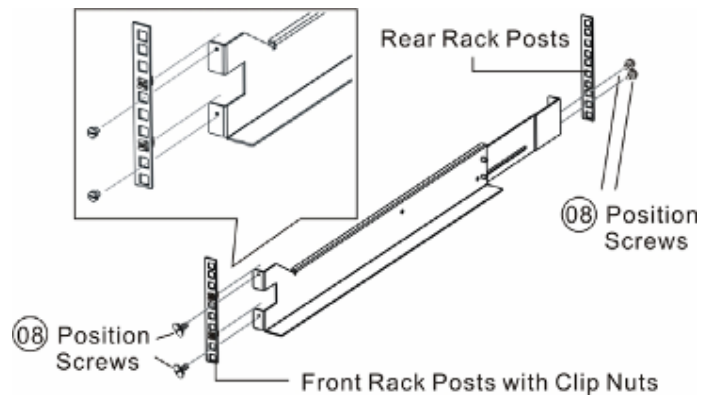


Figure 2-7: Securing Rail to Rack Post

- Step 5.** Attach the filler plates (#04) behind the enclosure ears using the three #6-32 x 12mm flat head screws (#09) on each side.

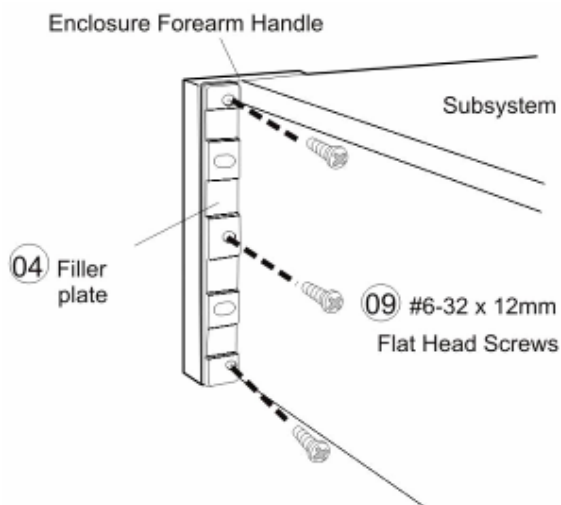


Figure 2-8: Securing a Filler Plate

- Step 6.** Place the enclosures onto the rails and slide the enclosure into rack until its chassis ears flush with the front rack posts. Two people are required.



Figure 2-9: Mounting the Enclosure

- Step 7.** Attach the rear supports to the rear side of the enclosure each using two #6-32 x 12mm flat head screws (#09).

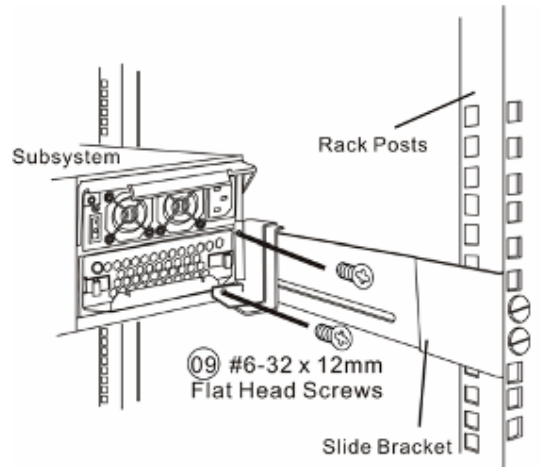


Figure 2-10: Installing Rear supports

Step 8. Fasten four M5 x 35mm screws (#10) through the holes on the forearm handles.

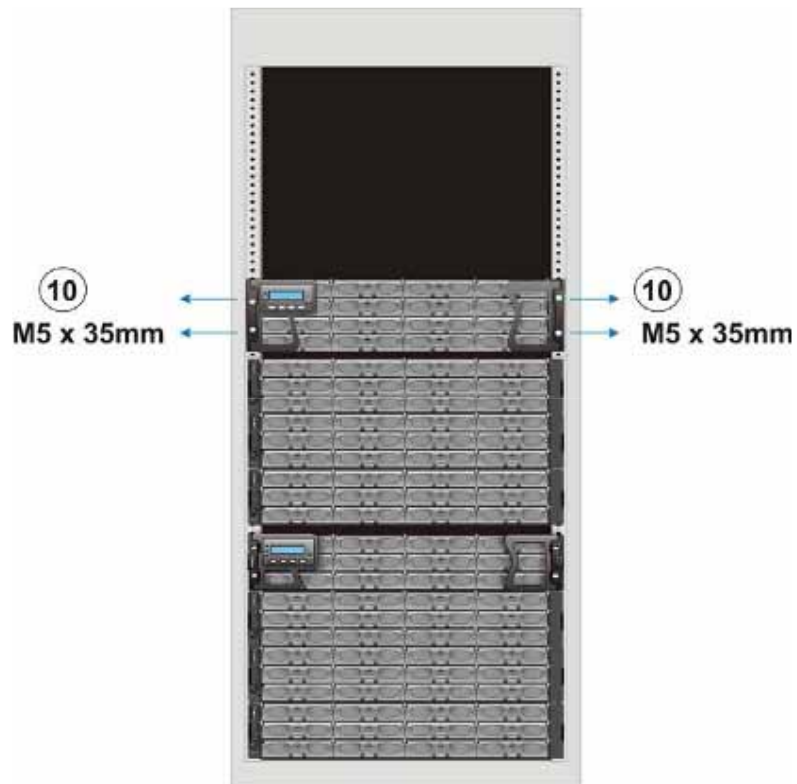


Figure 2-11: Securing Enclosure into Rack

2.7 BBU Installation

2.7.1 BBU Module Installation Overview

The BBU module is an optional item that can sustain cache memory in the event of a power failure or in the unlikely event of failing both PSUs. A BBU is highly recommended. The optional BBU provides additional data security and helps minimize the loss of data during power outage.

The BBU module is inserted into a module slot on the controller module. The BBU module is secured with two (2) retention screws. The FALCON iSCSI is shipped with a dummy plate on the BBU module slot.

2.7.2 BBU Warnings and Precautions

- f Install or replace the BBU module only with a BBU module supplied by your subsystem vendor. Use of battery cells provided by another source will void our warranty.
- f Always dispose of discharged or used batteries in an ecologically responsible manner. Dispose used BBUs at authorized battery disposal sites only.
- f Do not use nor leave the BBU near a heat source. Heat can melt the insulation and damage other safety features of battery cells, possibly leading it to acid leak and result in flames or explosion.
- f Do not immerse the BBU in water nor allow it to get wet. Its protective features can be damaged. Abnormal chemical reactions may occur, possibly causing functional defects, acid leak, and other hazardous results.
- f Do not disassemble or modify the BBU. If disassembled, the BBU could leak acid, overheat, emit smoke, burst and/or ignite.
- f Do not pierce the BBU with a sharp object, strike it with a hammer, step on it, or throw it. These actions could damage or deform it, internal short-circuiting can occur, possibly causing functional defects, acid leak, and other hazardous results.
- f If the BBU leaks, gives off a bad odor, generates heat, becomes discolored or deformed, or in any way appears abnormal during use, recharging or storage, immediately remove it from the subsystem and stop using it. If this is discovered when you first use the BBU, return it to RAID or your system vendor.

2.7.3 Installation Procedure

To install a BBU into the controller module, please follow these steps:

- Step 1.** Prior to installing the BBU module, power off the subsystem or restart the subsystem after installation. For power off procedures, please refer to **Section 4.4**.
- Step 2.** Use a screwdriver to **loosen the two (2) retention screws located on both sides of the dummy plate**. (See **Figure 2-12**)

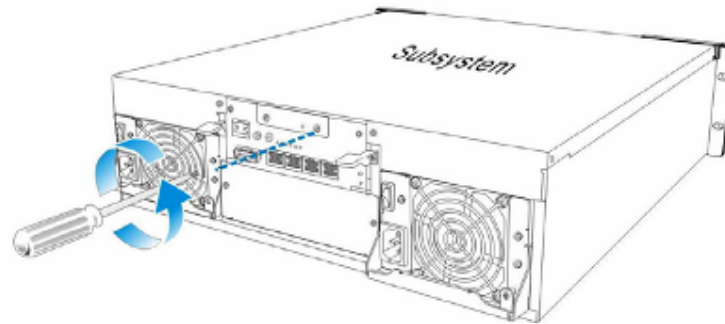


Figure 2-12: Loosening the BBU Retention Screws

- Step 3.** Once the retention screws are loosened, gently retrieve the dummy plate out of the enclosure. (See **Figure 2-13**)

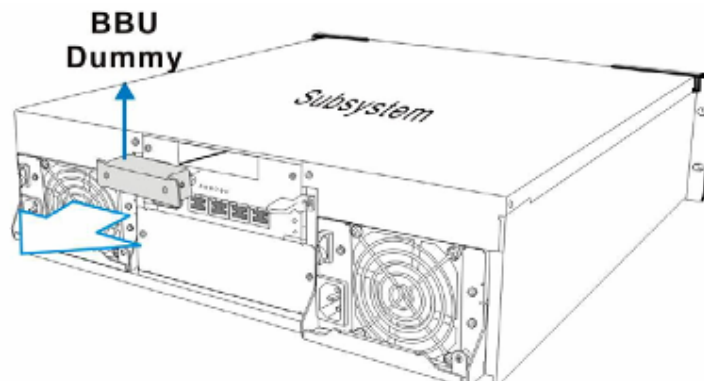


Figure 2-13: Removing the BBU Slot Dummy Plate



NOTE:

It may be difficult to remove the dummy plate as it is embedded in the subsystem chassis. If you are unable to dislodge the sheet, wedge the head of a flat-head screwdriver between the metal sheet and the chassis and then gently nudge the metal sheet out of the chassis.

Step 4. **Install the BBU module.** Align the BBU module with the BBU module slot and gently insert the BBU module until the module is fully inserted. Use slightly more force so that the back-end connector can mate with the backplane.

Step 5. **Secure the BBU module to the chassis.** Fasten the two (2) retention screws on the BBU module to secure the BBU module to the chassis. (See **Figure 2-14**)

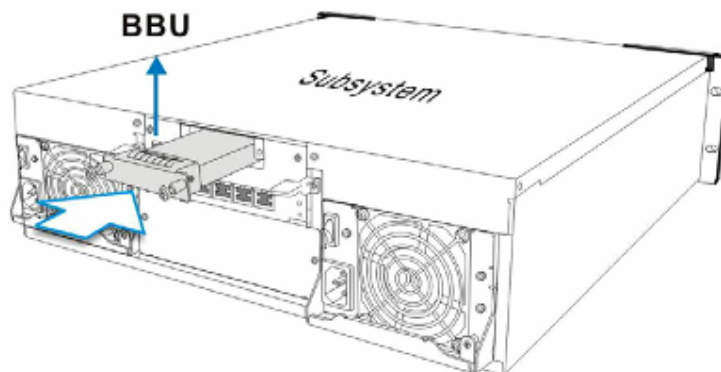


Figure 2-14: Installing the BBU Module



NOTE:

It is recommended to charge your BBU for at least twelve (12) hours on the first use.

2.8 Hard Drive Installation

2.8.1 Hard Drive Installation Prerequisites

Hard drives for the Falcon subsystem must be purchased separately. When purchasing hard drives, the following factors should be considered:

Capacity (MB/GB): Use drives with the same capacity. RAID arrays use a “least-common-denominator” approach. The maximum capacity of each drive used in the array is the maximum capacity of the smallest drive. Choose big drives with the same storage capacity.

Profile: The drive trays and bays of the system are designed for 3.5-inch-wide x 1-inch-high hard drives.

Drive type: This model accommodates SAS or SATA-II (3Gbps) hard drives.

MUX Board: MUX boards are required if using SATA drives in a redundant-controller configuration (R1130) both in RAID and the expansion enclosures.



CAUTION!

The hard drives and drive trays should only be installed into the subsystem after the subsystem has been mounted into a rack cabinet. If the hard drives are installed first, the subsystem will be too heavy to handle and the possible impact during installation may damage your drives.



WARNING!

1. Handle hard drives with extreme care. Hard drives are very delicate. Dropping a drive against a hard surface (even from a short distance) and hitting or touching the circuits on the drives with your tools may cause damage to the drives.
 2. Observe all ESD prevention methods when installing drives.
 3. Only use screws supplied with the drive canisters. Longer screws can damage the hard drives.
-

2.8.2 Drive Installation

- Step 1.** Place the hard drive into the drive tray (as shown below), making sure that the interface connector is facing the open side of the drive tray, and the label side facing up.

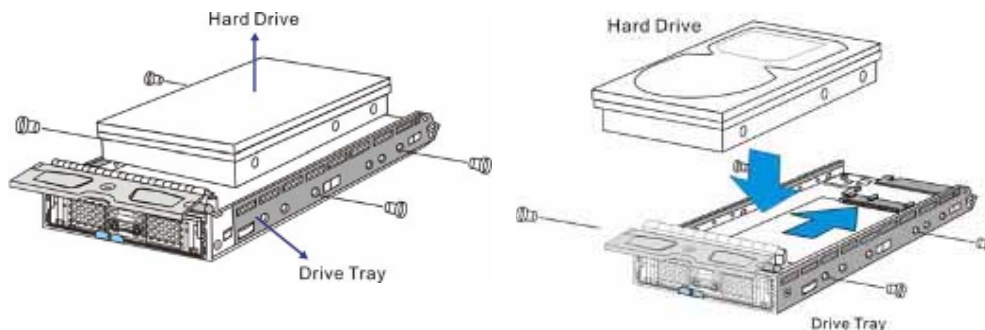


Figure 2-15: Installing a Hard Drive

- Step 2.** Adjust the drive's location until the mounting holes in the drive canister are aligned with those on the hard drive. Screws holes used for the installation with or without a MUX board are different.

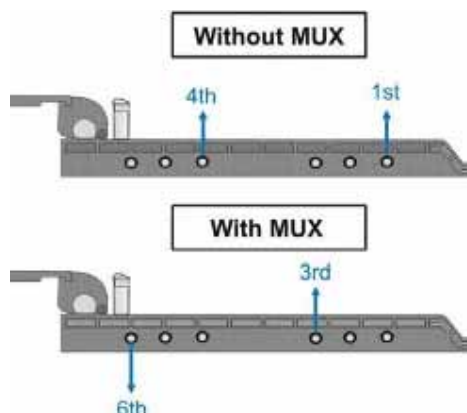


Figure 2-16: Drive Locations with and without the MUX Kit

- Step 3.** Secure the disk drive with four (4) of the supplied 6/32 flat-head screws.
- Step 4.** Once the hard drives are installed into drive trays, install all drive trays into the enclosure. See detailed instructions in the following section.

2.9 Drive Tray Installation

Once the hard drives have been secured within the drive trays, the drive trays can be installed into the subsystem.



WARNING!

All drive trays must be installed into the enclosure even if they do not contain a hard drive. If the trays are not installed into the enclosure, the ventilation airflow will not be normalized and the subsystem will overheat.

- Step 1.** Make sure **the rotary bezel lock is in the unlocked position**, i.e., the groove on its face is in a horizontal orientation. If the groove is in a vertical position, as shown in **Figure 2-17**, then the bezel lock is locked and the front bezel cannot be opened.

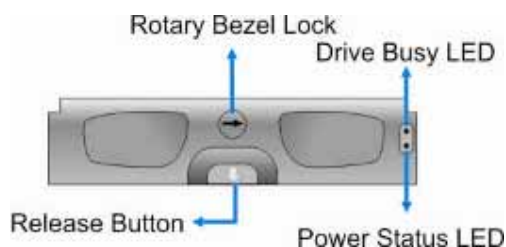


Figure 2-17: Front View of an Individual Drive Tray

- Step 2.** **Open the front bezel on the drive tray.)** Push the release button on the drive tray. The front bezel will spring open.

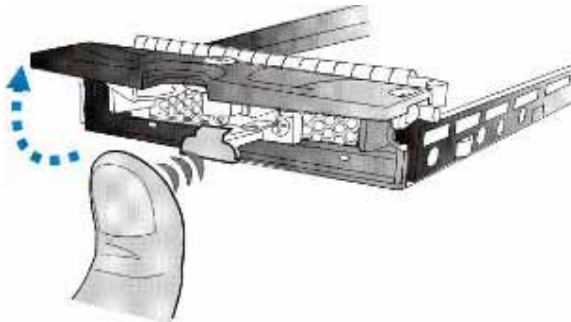


Figure 2-18: Drive Tray Release Button

- Step 3.** **Align the drive tray with the slot** in which you wish to insert it making sure that it is properly aligned within the drive bay. Gently slide it in until the drive tray reach the end of drive bay. This should be done smoothly and gently.



Figure 2-19: Installing a Drive Tray

- Step 4.** **Close the front bezel.** Make sure the front bezel is closed properly to ensure that the drive connector is properly mated with the corresponding connector on the backplane board. If the front bezel is not closed properly, the connection between the hard drive and the subsystem may come loose and mysterious drive signals may result.
- Step 5.** **Lock the bezel into place** by turning the key-lock until the groove on its face is pointing down (vertical orientation).

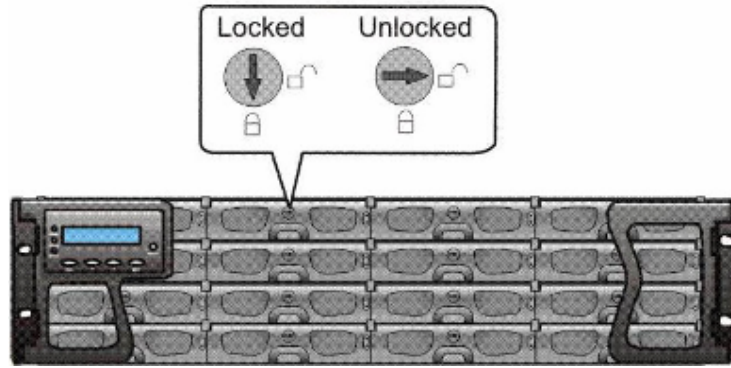


Figure 2-20: Securing Drive Tray by Turning the Bezel Lock

- Step 6.** Once the drive bays are populated and the subsystem powered on, the RAID controller will automatically spin up the hard drives and recognize their presence.

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Chapter 3

Subsystem Monitoring

3.1 Overview

The iSCSI subsystem is equipped with a variety of self-monitoring features that help keep system managers informed of the subsystem operational statuses. These monitoring features provide vital feedback to help you maintain the operational integrity of the subsystem. Prompt response to warnings and subsystem component failure notifications will ensure data integrity and help ensure the longevity of the subsystem.

The monitoring features include:

- f **Firmware:** The RAID controller in the subsystem is managed by preinstalled FW, which can be accessed using a PC hyper-terminal connected through the COM1 serial port. Device status information can be obtained from the FW-embedded configuration utility. The FW is fully described in the **Operation Manual** that came with your system. Please refer to this manual for further information.
- f **StorageWatch:** StorageWatch is a fully integrated, Java-based, Graphical User Interface (GUI) that came with the subsystem and can be used to monitor and maintain the subsystem locally or remotely over TCP/IP network. The management session is made using the 10/100BaseT management port. Please refer to the **StorageWatch User's Manual** for further details.
- f **LEDs:** Device-status-indicating LEDs are located on all modules. These LEDs inform you of the integrity of a given component or a host/management link. You should become familiar with the various LEDs and be aware of their functions.
- f **Audible alarm:** An audible alarm is present on the subsystem controller board and will be triggered if any of a number of threatening events occurred.

- f **Inter-Integrated Circuit (I²C):** The I²C serial bus connects temperature sensors and presence detection circuits within the chassis. Status report from the expansion enclosures is transmitted via the data links using the in-band protocols. No additional status link is necessary.

3.2 Status-indicating LEDs

3.2.1 LCD Keypad Panel

The LCD keypad as shown in **Figure 3-1** consists of five (5) buttons, three (3) LEDs, and a 16x2-character LCD screen that provides access to firmware-embedded utility. Press the **ENT** button for two (2) seconds on the initial screen to enter the main menu. Press the **ESC** button to clear the current event.

Function Keys:

Press the **UP** and **DOWN** arrow keys to select viewing items. In the bottom row of the main menu, "View and Edit Event Logs," the most recent event is displayed first.

Mute Button:

The **MUTE** button silences the alarm temporarily until the next event occurs.

The definitions of LEDs on the panel are given in **Table 3-1** below.



Figure 3-1: LCD Keypad Panel

Name	Color	Status
PWR (Power)	Blue	ON indicates that power is supplied to the subsystem. OFF indicates that no power is supplied to the subsystem or the subsystem/RAID controller has failed.
BUSY	White	FLASHING indicates that there is active traffic on the host/drive channels. OFF indicates that there is no activity on the host/drive channels.
ATTEN (Attention)	Red	ON indicates that a component failure/status event has occurred. OFF indicates that the subsystem and all its components are operating correctly.

Table 3-1: LCD Panel LED Definitions

**NOTE:**

During the power-on process, the ATTN LED will light up steadily. Once the subsystem successfully boots up with no faults, the ATTN LED will turn off.

3.2.2 Drive Tray LEDs

Two (2) LED indicators are located on the right side of each drive tray. (See **Figure 3-2**) Refer to **Table 3-2** for the LED definitions. When notified by a drive failure message, you should check the drive tray indicators to find the correct location of the failed drive. Replacing the wrong drive can fail two members of a logical array (RAID 3/5) and thus destroy data in it.

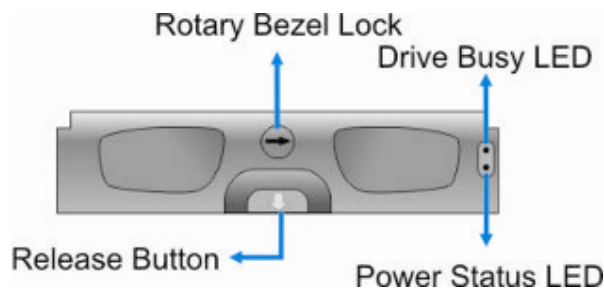


Figure 3-2: Drive Tray LEDs

Name	Color	Status
Drive Busy	Blue	FLASHING indicates data is being written to or read from the drive. The drive is busy. OFF indicates that there is no activity on the disk drive.
Power Status	Green / Red	GREEN indicates that the drive bay is populated. RED indicates that the disk drive has failed.

Table 3-2: Drive Tray LED Definitions

3.2.3 Controller Module LEDs

The LEDs on the rear-facing faceplate of the RAID controller are shown in **Figure 3-3**. The controller LEDs are numbered from 1 to 6. The definitions are shown below.

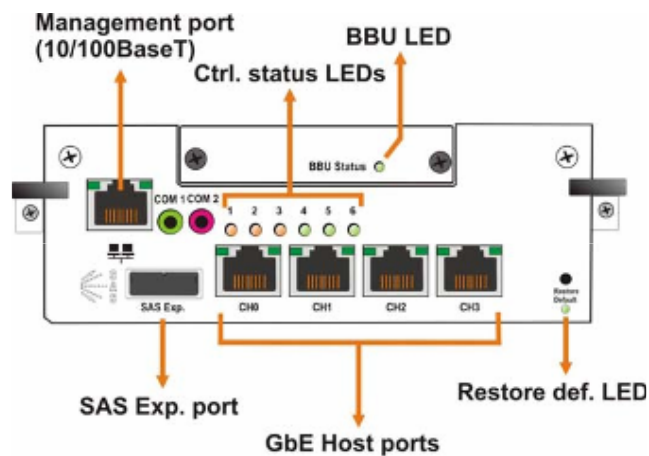


Figure 3-3: Controller Module LEDs

LED no.	Name	Color	Status
1	Ctlr Status	Green/ Amber	Green indicates that the RAID subsystem is operating healthily. Amber indicates that a component failure has occurred, or inappropriate RAID configurations have caused system faults.
2	C_Dirty	Amber	ON indicates the following: - Certain amounts of cached data held

			in memory. - Errors occurred with cache memory (ECC errors) - Cached data is sustained by battery backup. - Battery voltage is lower than 2.5V. - Battery temperature reading is abnormal (out of the 0 to 45°C range). - Battery is not present. OFF indicates that the cache is clean, and that the battery backup unit is capable of sustaining memory in case of power loss. This signal is local to each controller.
3	Temp.	Amber	ON indicates that the detected CPU/board/chassis temperature has exceeded the higher temperature threshold. OFF indicates that the detected temperature reading is within the preset safe range.
4	BBU Link	Green	ON indicates the presence of a BBU backup module.
5	Hst Bsy	Green	Rapidly Blinking to indicate traffic on the host bus.
6	Drv Bsy	Green	Rapidly Blinking to indicate traffic on the drive channels.
-	Restore Default	Green	Lit Green to indicate the RAID configuration default has been successfully restored. The LED state will be invalidated after a few seconds. See below for how to use the push button.
Table 3-3: Controller LED Definitions			

How to Use the Restore Default Button?



CAUTION!

The Restore NVRAM Default push button should be considered as a last-resort function. Although restoring firmware defaults will not destroy the existing logical drives; however, if the existing logical drives cannot be adequately associated with host ID/LUNs after default restoration, data inconsistencies might occur.

There is a non-latch type push button accessed through an opening on the controller faceplate.

Why restoring defaults?

1. Some of the latest firmware updates may be incompatible with the firmware currently running on your subsystem. These updates may require restoring firmware defaults before firmware upgrade can actually take place. Before using the button, it is highly advised to practice the following:

- f Stop host I/Os,
- f Save NVRAM,
- f Make a list of host ID/LUN mapping information for future references.

You may also jot down the configuration parameters such as the performance preferences, specific stripe sizes, etc.

2. When you upgrade controller DIMM module to 2GB. Firmware has an embedded 1GB threshold for internal settings such as the supported no. of logical drives. Restore firmware defaults after you upgrade your DIMM module to 2GB.
3. Another condition that requires restoring defaults is when a system administrator forgets the password controlling the access to a RAID system. Before pushing this button, also practice the steps listed above. You can access array information even without a password.

Listed below are the necessary procedures that should be completed before using this button:

1. Before pressing this button to restore firmware defaults, it is highly advised to save you current configuration using the “**Save NVRAM**” function in firmware utility or the StorageWatch GUI.
2. You may also make a list of the existing ID/LUN mapping information. You will need the list for restoring ID/LUN mapping

after restoring defaults. Default restoration will erase the ID/LUN mapping associations (e.g., which logical drive is associated with which host ID/LUN), and it is necessary to restore the host ID/LUN mapping after firmware default restoration in order to access data on the previously configured arrays.

How to use the button?

Single-controller:

After the subsystem is powered down, you can use the included bezel key or a straighten paper clip to press the button. Press and hold the button down, power on the subsystem, and wait for the associated LED and the subsystem **Ready** LED to light up. The **“Restore Def.”** LED and the firmware **“Default Restored”** event indicate successful restoration of firmware defaults.

Redundant-controller:

With redundant RAID controllers, the procedure can be more complicated:

- Step 1.** Remove controller B from the subsystem, power down, and then power on with the “Restore Def.” button depressed to restore the firmware defaults on the remaining controller.
- Step 2.** When the “Restore Def.” LED is lit and the “default restored” firmware event appears on the LCD screen, release the button. You may ask your colleague to observe the message on the other end of the chassis to see if the “default restored” event appears.
- Step 3.** Power down, install controller B to the controller A slot, and repeat the restoration process.
- Step 4.** When completed with restoring defaults on both controllers, install both controllers and power on.

3.2.4 Ethernet Port LEDs

Four (4) GbE host ports, which provide different connection speeds, are located on the controller faceplate. Shielded Cat5e straight-through Ethernet cables can be used to connect the RJ-45 ports to the network. Two (2) LEDs located on each Ethernet port indicate the Ethernet connection speed and link status. See the diagram below for the locations of the two (2) LED indicators. Refer to **Table 3-4: GbE LAN Port LED Definitions** for definitions of the GbE host ports, and **Table 3-5: 10/100BaseT Management Port LED Definitions** for LED definitions of the fast Ethernet management port.

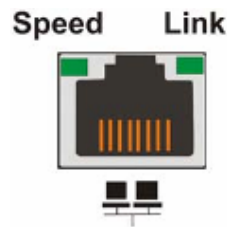


Figure 3-4: GbE LAN Indicators

Name	Color	Status
Speed	Green	ON indicates currently connected with GbE speed, OFF means connected with 10/100 speed.
LAN Link	Green	ON for linked. BLINKING indicates active transmission.

Table 3-4: GbE LAN Port LED Definitions

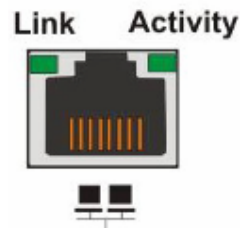


Figure 3-5: 10/100BaseT Management Port Indicators

Name	Color	Status
Link Status	Green	ON indicates currently connected to a LAN.
LAN Activity	Green	BLINKING indicates active transmission.

Table 3-5: 10/100BaseT Management Port LED Definitions

3.2.5 BBU Module LED

The BBU module has an LED on its faceplate. The function is the same as the similar LED on the controller module. The LED is off when the BBU is functioning normally and is able to sustain the cache memory. The LED flashes to indicate the BBU is charging. If the LED is illuminating amber, the BBU may have lost its ability to hold electrical charge. You should then contact your vendor to verify the problem.

**IMPORTANT!**

In addition to BBU failure itself and the charger failure, the subsystem may also light the BBU fault LED when the following occur:

1. The temperature sensor embedded with the charger circuit reports a temperature reading exceeding 45 degree Celsius.
2. The BBU (battery backup unit) has been charged for over 12 hours. The BBU charger will enter a timer fault state.

When the above conditions occur, the charger circuit will enter a low-power and self-protection state.

You may correct the faults when receiving a “BBU Thermal Shutdown/Enter Sleep-Mode!” event message:

1. Check proper ventilation within the subsystem. You may also check the readings from other sensors within the enclosure. Airflow might have been disrupted by the absence of one or several major modules or the failure of a cooling fan. Once the thermal condition is improved, charging will resume automatically.
 2. If a new battery module has been charged for over twelve (12) hours and this event is issued, you may remove and re-install the battery module. An empty battery module may take more than 12 hours to fully charge. There is a timer embedded with the charger, doing so can reset the timer. Charging will resume automatically.
 3. If you install or replace a BBU, the subsystem recognizes the presence of BBU only after a system reset.
-

3.2.6 PSU LEDs

Each PSU comes with a single LED at the back (see **Figure 3-6**), located close to the power switch that turns on the subsystem. This LED indicates the operational status of the PSU module. Please refer to the PSU LED definitions shown in **Table 3-6**.

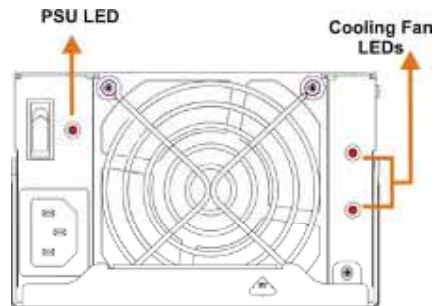


Figure 3-6: PSU Module LED

Color	Status
Steadily Blinking Green	The power supply has not been turned on. The PSU module LED will blink when the subsystem is connected to a power source but not yet turned on.
Static Green	The PSU is operating normally and experiencing no problem.
Static Red	The PSU has failed and is unable to provide power to the subsystem.
OFF	The PSU is not turned on and the power cord is disconnected.

Table 3-6: PSU Module LED Definitions

3.2.7 Cooling Module LEDs

Each individual cooling fan within the cooling module has one (1) red LED on the PSU module. The LED corresponds to the single fan in the cooling module. When the LED is on, it indicates the fan has failed. When the LED is off, it indicates the fan is functioning properly.

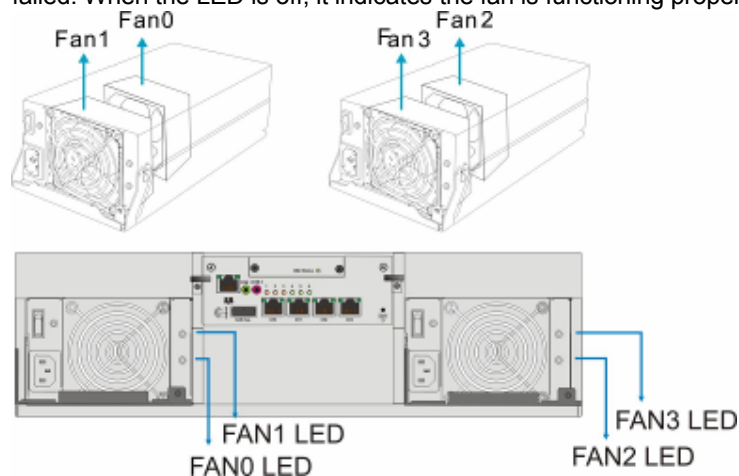


Figure 3-7: Cooling Module LEDs and Cooling Fan Locations

The subsystem has a novel approach to stabilizing the temperature within the subsystem: When the intelligent sensors on the backplane detect elevated temperature, such as high ambient temperature or the failure of any cooling or PSU module, the system will turn the cooling fans to high speed to extract more heat. Once the ambient temperature cools down to normal or the failed modules have been replaced, the cooling fans will return to low speed.

3.3 Audible Alarm

Different environmental and operational parameters (like temperature, etc.) have been assigned a range of values between which they can fluctuate. If either the upper or lower thresholds are exceeded, an audible alarm will be triggered. The alarm will also be triggered when a component fails. If the system administrator is onsite and hears an alarm, the manager must read the error message on the terminal or StorageWatch screen to determine what has triggered the alarm. After determining what has occurred, the system administrator must take appropriate actions to rectify the problem.



WARNING!

If an alarm is triggered it is necessary for you to determine the problem. If the audible alarm is ignored and the problem is not rectified, unexpected damages may occur.

3.3.1 Failed Devices

If any of the following components fails, the audible alarm will be triggered:

- ƒ RAID controller module (in a redundant-controller configuration)
- ƒ Cooling fan modules
- ƒ PSU modules
- ƒ BBU module
- ƒ Hard disk drives
- ƒ Sensors or presence detection circuitries



NOTE:

When temperature exceeds a preset threshold, the controller's

charger circuits will stop charging. You will then receive a message that reads "Thermal Shutdown/Enter Sleep Mode." When the temperature falls back within normal range, the battery will resume charging.

3.4 I²C

The operating status of PSU and cooling fan modules are collected through an I²C serial bus. If either of these modules fails, the failure will be detected and you will be notified through the various methods described above.

Chapter 4

Subsystem Connection and Operation

4.1 Connection Overview

4.1.1 Cabling

Following are the requirements on the type of cables used to connect the subsystem's iSCSI host ports:

1. Ethernet cables are user-supplied. Cat5e shielded STP type network cables or better performance types (important for meeting the requirements imposed by emission standards). A shielded STP, twisted-pair cable is available as an accessory.
2. Straight-through Ethernet cables with RJ-45 plugs.
3. Use of cross-over cables can also be automatically detected and re-routed for a valid connection.

Connection:

1. Directly to iSCSI initiators (software or hardware) or via Gigabit Ethernet switches.
2. To servers equipped with iSCSI HBA [better be a hardware TOE (TCP/IP Offload Engine) card], and then to client stations with an Ethernet NIC or iSCSI HBA.
3. The subsystem presents its logical volumes through SCSI-like IDs and LUNs. These RAID volumes then appear as iSCSI targets through the network.



NOTE:

Even though iSCSI initiator software is a cost-effective way of building an iSCSI SAN, software initiator adds additional workload to the server CPU. It is recommended to apply iSCSI HBAs that come with TCP/IP offload engines in order to reduce overhead.

**WARNING!**

All cables must be handled with care. Make sure Ethernet cables do not run parallel with power cords. To prevent interference within a rack system, the cable routing path must be carefully planned and they must not be bent.

4.1.2 Network Topologies

The iSCSI host ports connect to Ethernet network devices and iSCSI initiators that comply with the IETF iSCSI standard (RFC 3720). Network connection of the iSCSI ports is flexible. The use of network connecting devices, subnet, Name Servers, or iSCSI management software can vary from case to case. In the following sections, configuration diagrams will be provided to illustrate the possible uses of the Falcon iSCSI subsystem in an iSCSI network.

Note that these configurations only recommend but do not intend to impose limitations on the use of subnet settings or networking paths to data servers.

4.1.3 Points of Failure

The primary concern for configuring host-side topologies is to avoid **points of failure**. It is therefore preferred that two HBA cards are installed on the host side and better not the onboard Ethernet. Data flow and access management should therefore be implemented to avoid access contention. RAID's StoragePath™ software can be implemented in order to access a RAID volume through an alternate data link in the event of cabling failure.

4.2 Host Connection Topologies

Drawing Legends

	A host computer or a client station.
	An iSCSI initiator, either a single- or dual-ported host adapter card
	Instances of the multi-pathing driver to encompass 2 or more fault-tolerant paths
	A GbE network switch

	iSCSI ports on a RAID controller (controller A or controller B)
	A logical drive consisting of multiple physical drives
	A physical data link
	A logical association, e.g., that between a logical drive and a host port
	An asterisk indicates a logical drive's assignment (a preferred ownership) either to RAID controller A or RAID controller B
	Data paths combined using the “multi-connections per session” methodology. (Firmware rev. 3.64) In iSCSI specifications, this is defined as a group of network ports for an iSCSI TCP session. A single GbE port delivers an approximate 100MB/s throughput. Combining two GbE ports into a portal group can double the bandwidth. You can combine up to 4 ports into a group.

Note the following with the configuration as diagrammed below:

1. Use the 10/100BaseT Ethernet port for management purposes, i.e., StorageWatch or telnet console. This 10/100BaseT port is not used for I/O transactions.
2. Configurations such as subnet or Virtual LAN can separate iSCSI host links, decreases overheads, and eliminates the impact of link failure.
3. Multiple arrays or logical partitions can be created and made available separately through different IDs or LUN numbers on the host ports. A RAID5 logical drive of 8 members often brings optimal array performance. A logical drive composed of only 3 members may not deliver the best performance. You may attach expansion enclosures to expand system capacity.

4.2.1 Sample Topology – Direct-Attached with Fault-tolerant Paths

Component	Description	#
RAID system: FALCON iSCSI	iSCSI RAID managed by a single controller, with 4 host ports	1
HBA	iSCSI initiators, better be PCI-E TOE cards	2
GbE cables	GbE network cables	4
Software	StoragePath to manage the fault-tolerant paths with failover/failback and load balance	-

RAID configuration	2 logical drives (each has 8 member drives) LD0 mapped to CH0 ID and CH2 ID LD1 mapped to CH1 ID and CH3 ID * Each logical drive appears on two different HBA cards for the purpose of fault tolerance. Use StoragePath multi-pathing software so that your operating system can identify alternate paths to the same logical drive.	
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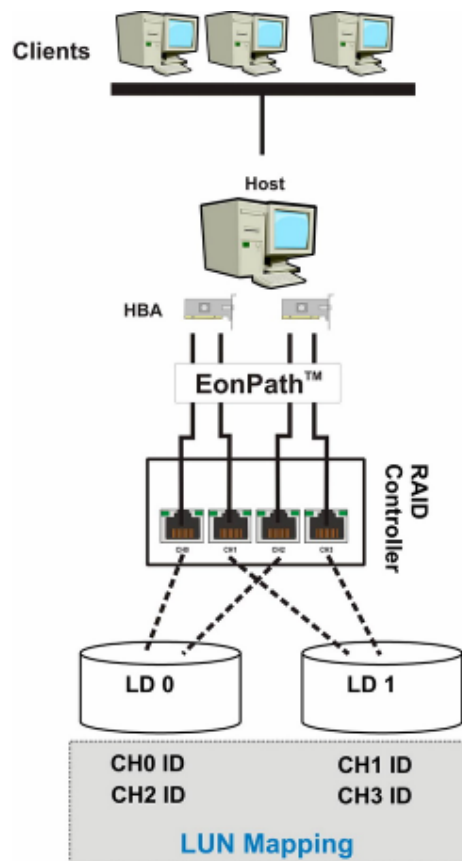


Figure 4-1: Sample Topology: Direct-attached with Fault-tolerant Paths

4.2.2 Sample Topology – IP SAN with Fault-tolerant Paths via GbE Switch

Component	Description	#
RAID system: iSCSI-Single Cont.	iSCSI RAID managed by a single controller, with 4 host ports	1
HBA	iSCSI initiators, better be PCI-E TOE cards	4
GbE cables	GbE network cables	8
GbE switch	Ports divided into 2 virtual LANs to separate access from host to targets.	1
Software	StoragePath to manage the fault-tolerant paths with failover/failback and load balance capabilities. Use StoragePath multi-pathing software so that your operating system can	-

	identify alternate paths to the same logical drive.	
RAID configuration	2 logical drives (each has 8 member drives) LD0 mapped to CH0 ID and CH1 ID LD1 mapped to CH2 ID and CH3 ID	

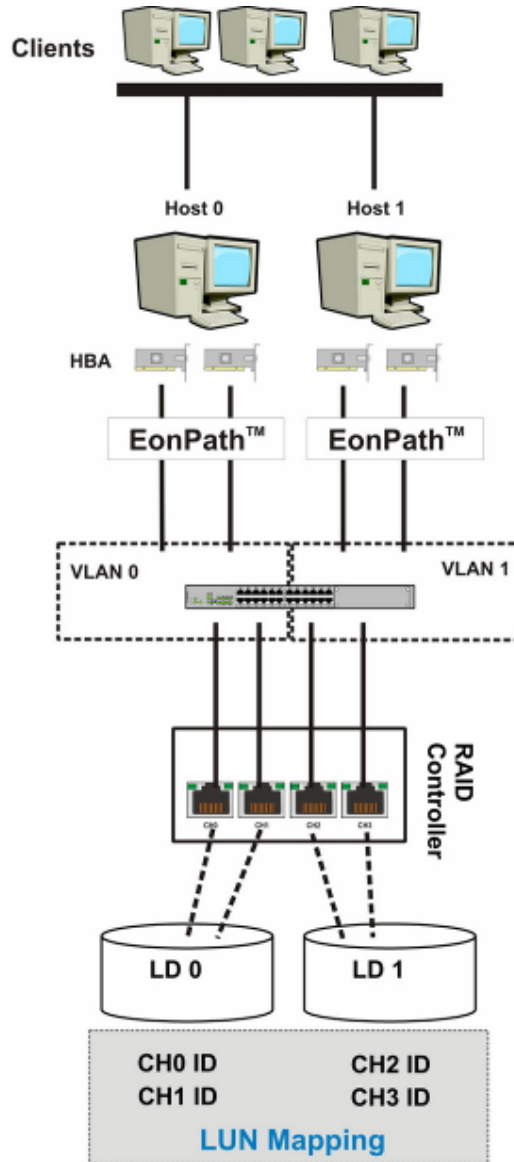


Figure 4-2: IP SAN with Fault-tolerant Paths via GbE Switch

4.2.3 Sample Topology – High Availability IP SAN with Redundant RAID Controllers

Component	Description	#
RAID system: iSCSI-R1130	iSCSI RAID managed by redundant RAID controllers, with a total of 8 host ports	1
HBA	iSCSI initiators, better be PCI-E TOE cards	4
GbE cables	GbE network cables	12
GbE switch	Ports divided into 2 virtual LANs to separate access from host to targets.	1
Software	StoragePath to manage the fault-tolerant paths with failover/failback and load balance capabilities. Use StoragePath multi-pathing software so that your operating system can identify alternate paths to the same logical drive.	-
RAID configuration	4 logical drives (each has 4 member drives; for better performance, you can include drives from JBOD) LD0 mapped to CH0 AID and CH0 BID; LD assigned to controller A LD1 mapped to CH1 AID and CH1 BID; LD assigned to controller A LD2 mapped to CH2 AID and CH2 BID; LD assigned to controller B LD3 mapped to CH3 AID and CH3 BID; LD assigned to controller B	

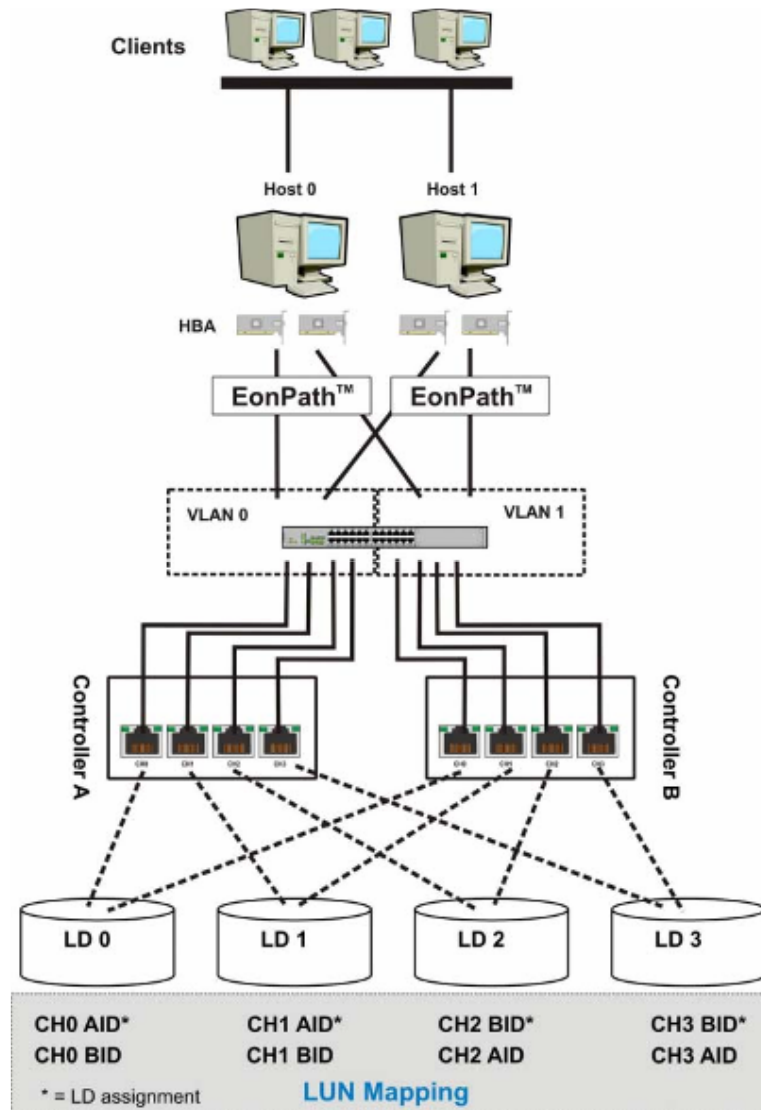


Figure 4-3: High Availability IP SAN with Redundant RAID Controllers

**NOTE:**

In the event of single controller failure, a logical drive is accessed through the host IDs managed by the alternate RAID controller. Host IDs and port IPs do not fail-over to the surviving controller. Therefore, the StoragePath multi-pathing driver is

necessary for path redundancy and controller failover.

4.2.4 Sample Topology – High Availability IP SAN with Multiple Connections per Session (Firmware revision 3.64)

Component	Description	#
RAID system: iSCSI-R1130	iSCSI RAID managed by redundant RAID controllers, with a total of 8 host ports	1
HBA	iSCSI initiators, better be PCI-E TOE cards	4
GbE cables	GbE network cables	12
GbE switch	Ports divided into 2 virtual LANs to separate access from host to targets.	1
Software	StoragePath to manage the fault-tolerant paths with failover/failback and load balance. Use StoragePath multi-pathing software so that your operating system can identify alternate paths to the same logical drive.	-
RAID configuration	2 logical drives (each has 8 member drives). More logical drives can be created from drives in JBOD. LD0 mapped to CH0 AID and CH0 BID; LD assigned to controller A LD1 mapped to CH2 AID and CH3 BID; LD assigned to controller B CH0 and CH1 are combined into a portal group. CH2 and CH3 are combined into another portal group. Portal groups enable multiple connections per iSCSI session, and double the applicable bandwidth per session.	

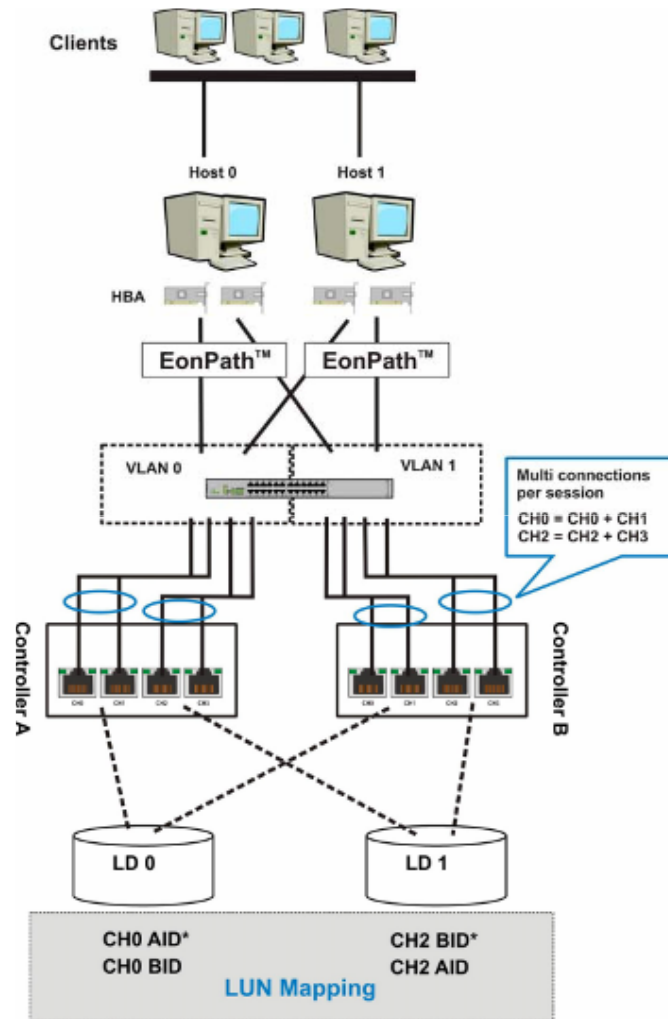


Figure 4-4: High Availability IP SAN with Multiple Connections per Session

**NOTE:**

In the event of single controller failure, a logical drive is accessed through the host IDs managed by the alternate RAID controller. Host IDs and port IPs do not fail-over to the surviving controller. Therefore, the StoragePath multi-pathing driver is necessary for path redundancy and controller failover.

iSCSI Topology and Host LUN Mapping:

Configuration Details:

1. A logical drive can be associated with several SCSI IDs on separate channels making it a RAID volume accessed through different data paths. The default ID on every host channel is ID#0. More can be created if the need arises.
2. You can manually include or exclude specific iSCSI initiators from the access list to your iSCSI arrays. A number of access conditioning factors can be included: IQN, NetMask value, CHAP, and IP addresses can be associated with a RAID array (a logical drive). In this way, only the authorized host adapters can access your arrays.
3. In the sample below, 2 logical drives are created each out of 8 member drives. Depending on your demands for logical RAID volumes, specific array parameters such as spare drives, RAID level, and stripe size/width, can be specified when creating logical drives.
4. Subnet and Virtual LAN can be created to reduce overheads, to contain broadcast, and provide access security. LAN configuration is beyond the scope of this hardware manual.
5. Multiple arrays or multiple partitions can be created and made available separately through different IDs or LUNs on the host ports. The RAID volumes appear as shared storage over the Ethernet network.
6. To ensure optimal performance, make sure you connect the iSCSI RAID to a high speed Gigabit Ethernet network.

4.3 Expansion Links

4.3.1 Single-controller RAID to single-controller JBOD

An SFF-8088 to SFF-8470 cable is required. IN ports and OUT ports are specified on the JBOD controller faceplates.

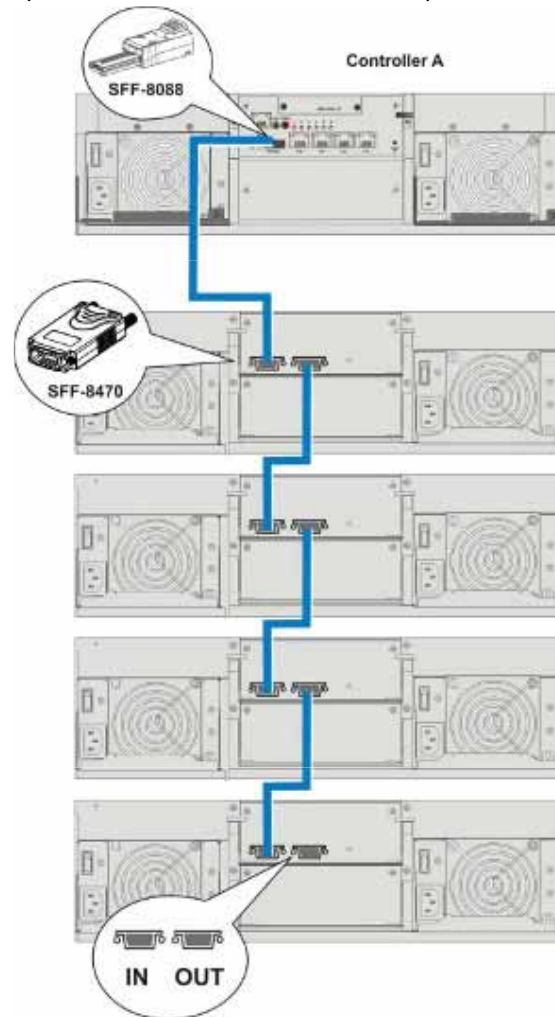


Figure 4-5: JBOD Expansion Links with Single-controller JBOD

4.3.2 Dual-controller RAID to dual-controller JBOD.

Two (2) SFF-8088 to SFF-8470 cables are required.

Expansion Link Considerations:

1. A 120cm cable may be necessary as an expansion link if you route the fault-tolerant cables from opposite directions. Routing cables from opposite directions allows uninterrupted access to the disk drives in other enclosures when one expansion enclosure fails among them.
2. A 120cm is also necessary if you have bend radius concerns in your rack cabinet. The bend radius for SAS cables is 2.2 inches minimum.
3. The IN and OUT ports are specified on JBOD controllers' faceplates.

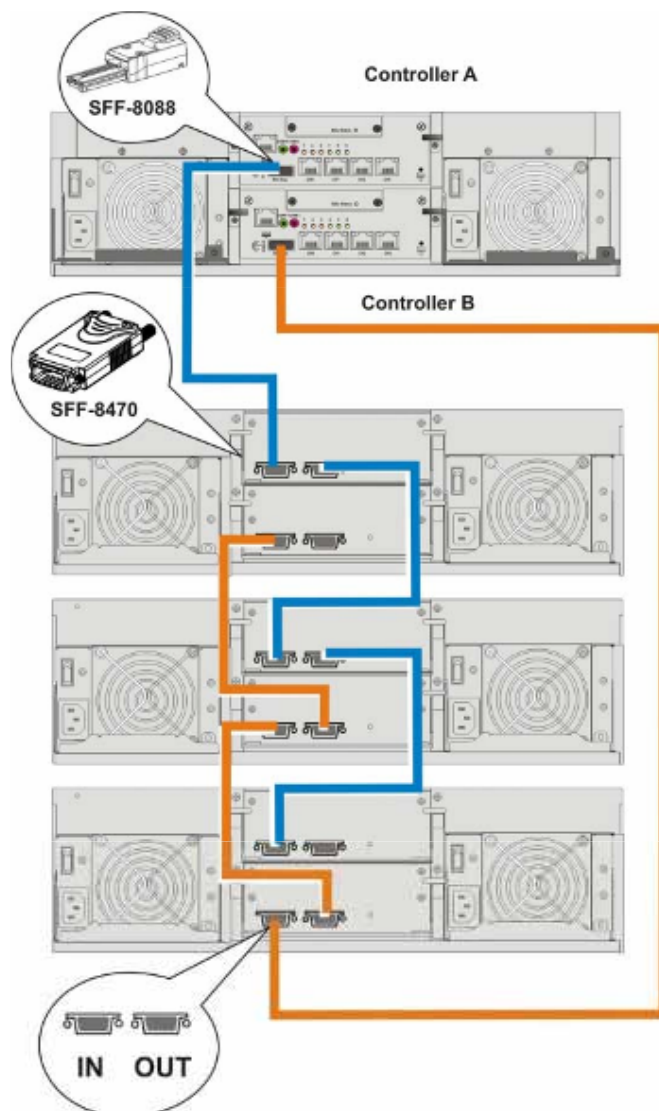


Figure 4-6: JBOD Expansion Links with Dual-controller JBOD

4.3.3 Enclosure ID and Other Concerns

IMPORTANT!

- 2-1. **MUX boards** are necessary using SATA drives in a redundant-controller configuration, i.e., the “R” models, both in RAID or JBOD enclosures.
- 2-2. These models only support SATA-II disk drives (at the **3Gbps** speed). Some disk drives may come defaulted to the 1.5Gbps speed. You may need to configure their speed using jumpers or firmware configuration utility. Please consult your drive vendor.
- 2-3. **Mixing SAS and SATA** drives in an enclosure is allowed; however, there are concerns for such use:
 - 2-3.1. SAS drives spin at a higher RPM, and if you place a column of slower SATA drives in between high-RPM SAS drives, erroneous drive behaviors may occur.

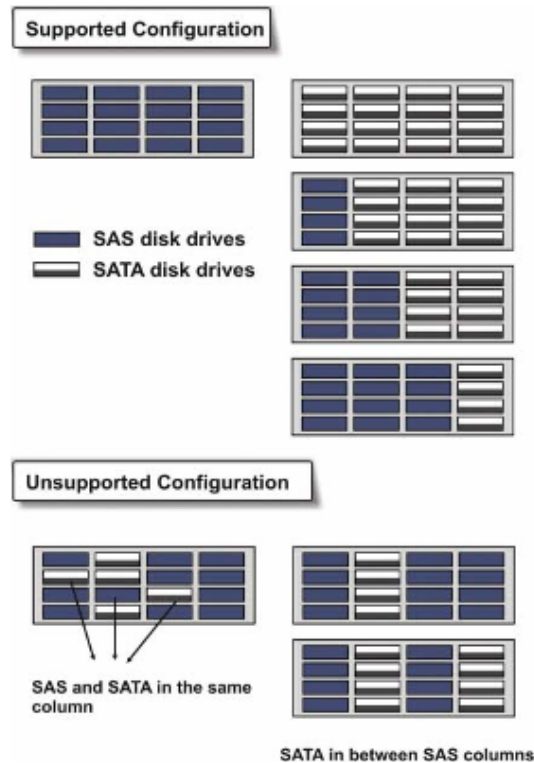


Figure 4-7: Supported and Unsupported Configurations Mixing SAS and SATA Drives

- 2-3.2. SAS and SATA drives come with different capacities. Do not include drives of different capacities in a logical drive. Otherwise, some part of the larger drives' capacity will be wasted. RAID firmware always uses the maximum capacity of the smallest drive as the standard capacity of all member drives when composing a logical drive.

2-4. **SAS WWN addresses:**

SAS expansion links are made via SAS expander chips, and there are specific WWN addresses for the devices connected through these chips. When making expansion, make sure you select a unique ID using the rotary switch on JBOD.

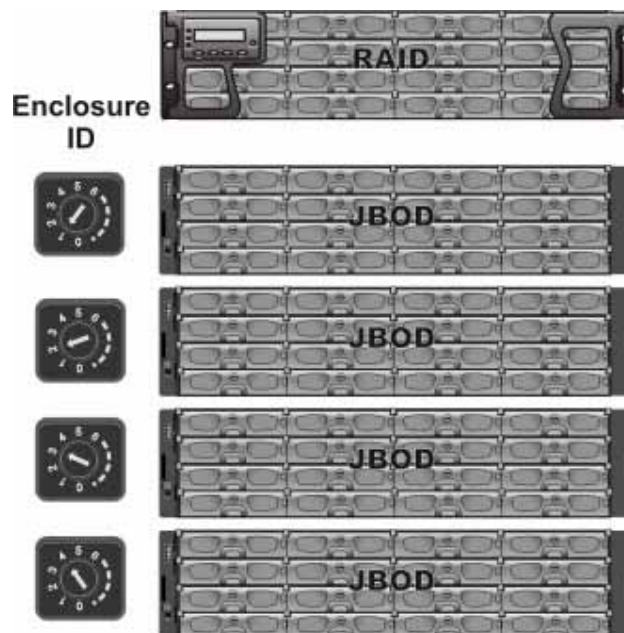


Figure 4-8: Enclosure ID Configuration

Please note that the JBOD enclosure ID always starts from “1.” Setting an ID to “0” may cause address conflicts with those already occupied by SAS expander chips.

4.4 Power On

Once all the components have been installed in the Falcon subsystem, the iSCSI ports have been connected to the network, power on the network devices, the subsystem, and then power on the servers/iSCSI initiators.

4.4.1 Check List

BEFORE powering on the Falcon subsystem, please check the following:

- ... **Memory Modules** – Memory modules have been correctly installed on the controller boards. You may skip this if you have not changed the pre-installed module.
- ... **BBU Modules** – If used, that the BBU module has been installed correctly.
- ... **Hard Drives** – Hard drives have been correctly installed on the drive trays.
- ... **Drive Trays** – **ALL** the drive trays, whether or not they have a hard drive, have been installed into the subsystem.
- ... **Cable Connections** – The iSCSI ports on the subsystem have been correctly connected to the initiators or the Ethernet network.
- ... **Power Cords** – The power cords have been connected to the PSU modules on the subsystem and plugged into power source.
- ... **Ambient Temperature** – All the subsystem components have been acclimated to the surrounding temperature.

4.4.2 Power On Procedure

When powering on the Falcon subsystem, please follow these steps.

- Step 1. Power on the network connection devices.**

These devices include the Ethernet switches, routers, and any other such devices that have been connected to the Falcon iSCSI subsystem. Please refer to the documentation that came with your network device to see the power on procedure.
- Step 2. Power on the Falcon subsystem.**

The Falcon subsystem should only be powered on after all the network connection devices have been powered on. Consult your network administrators for proper network configurations. The power on procedure for the Falcon subsystem is described below.
- Step 3. Power on the initiators.**

The servers or iSCSI initiators should be the last devices that are turned on. Please refer to the documentation that came with your application servers to see their own power on procedures.

4.4.3 Power On Enclosure

To power on the subsystem, turn on the two power switches located on the rear panel of the subsystem. Each switch controls a single PSU, therefore make sure that both switches are turned on. There is no limitation on which PSU should be powered on first.

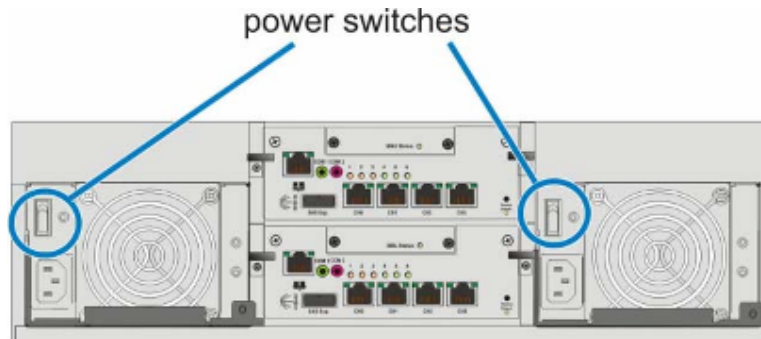


Figure 4-9: Power Switches



CAUTION!

Although the PSUs are redundant and a single PSU can provide sufficient power to the subsystem, it is advisable to turn both of the power switches on. If only one PSU is operating and fails, system operation will be terminated.

4.4.4 Power On Status Check

Once the subsystem has been powered on, the status of the entire subsystem should be checked to ensure that everything is running smoothly and that there are no complications or malfunctions.

- ... **Controller Module LEDs** – The controller Ready LED should flash green.
- ... **Drive Tray LEDs** – The drive status LEDs (that contain hard drives) should all lights blue.
- ... **Firmware and StorageWatch** – The overall status of the system may be checked using the embedded firmware utility or the StorageWatch GUI screen.
- ... **Audible Alarm** - If any errors occur during the initialization process, the onboard alarm will sound in a hastily repeated manner.

Drive tray LEDs should normally start flashing right after the power-on self-test, indicating the RAID control unit is attempting to access the hard drives.



NOTE:

The subsystem has been designed to run continuously. Even if a component failure occurs the fault can be corrected online.

4.5 Power Off Procedure

To power down the Falcon subsystem, please follow these steps:



NOTE:

When powering down the Falcon subsystem, please ensure that no time-consuming processes, like a “Logical Drive Parity Regeneration” or a “Media Scan,” are taking place.

Step 1. Stop I/O access to the system.

Stop all I/O access to the iSCSI subsystem. Please refer to the related documentation of your applications.

Step 2. Flush the cache.

Locate the Cache_Dirty LED on the back of controller module to check if there is data cached in the memory. Use the “Shutdown Controller” function to flush all cached data. This prepares the RAID subsystem to be safely powered down.

Step 3. Turn off the power.

Turn off the power. Once the RAID subsystem has been powered down, other devices connected to the subsystem can be powered down.

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Chapter 5

Subsystem Maintenance and Upgrading

5.1. Overview

5.1.1 Maintenance

Constant monitoring and maintenance of your Falcon iSCSI subsystem will minimize system downtime and preserve the working integrity of the system for a longer period of time. If any of the system components fails, they must be replaced as soon as possible.



WARNING!

Do not remove a failed component from the subsystem until you have a replacement on hand. If you remove a failed component without replacing it, the internal airflow will be disrupted and the system will overheat causing damage to the subsystem.

All of the following components can be replaced in case of failure:

1. Controller module – **Section 5.2**
2. Memory module – **Section 5.3**
3. BBU module - **Section 5.4**
4. PSU modules – **Section 5.5**
5. Cooling fan modules (bundled with PSU modules, not separately available) – **Section 5.6**
6. Hard drives – **Section 5.7**

5.1.2 General Notes on Component Replacement

- f* In a redundant-controller configuration, a RAID controller is hot-replaceable. In a single-controller configuration, the RAID controller is not hot-swappable. All other component modules, including the PSU modules (along with the cooling modules within), BBU, and drive trays, are hot-swappable and can be replaced while the subsystem is still in operation.

- f Qualified engineers who are familiar with the subsystem should be the only ones who make component replacements. If you are not familiar with the subsystem and/or with RAID subsystem maintenance in general, it is strongly advised that you refer system maintenance to a suitably qualified engineer.
- f Normalized airflow is directly dependent on the presence of all system components. Even if a subsystem component fails, it should not be removed from the subsystem until a replacement is readily at hand and can be quickly installed. Removing a subsystem component without replacing it can lead to permanent damage.
- f When replacing any hot-swappable component, caution should be taken to ensure that the components are handled in an appropriate manner. Rough or improper handling of components can lead to irreparable damage.
- f When removing a RAID controller from the subsystem, ensure that your applications running on servers have been properly closed, users notified of the down time, all cached writes conducted, etc. Ensure that power has been turned off and that all precautionary measures, without exception, are adhered to. The controller board is very sensitive and can be easily damaged.



WARNING!

When inserting a removable module, take heed that **DO NOT USE EXCESSIVE FORCE!** Forcing or slamming a module can damage the connector pins either on the module itself or on the backplane. Gently push the module until it reaches the end of module slot. Feel the contact resistance and use slightly more force to ensure the module connectors are correctly mated. If the module comes with ejection levers or retention screws, use them to secure the module.

5.2. Replacing a Controller Module

5.2.1 Overview

The controller module consists of the following components:

- f DIMM Module The DIMM module can be replaced when a DIMM module fails or if a larger capacity DIMM is required.
- f BBU If the BBU has lost its ability to hold electric charge, replace it with a certified module. With the new BBU that comes with ASIC400 models, an EEPROM is implemented and that system administrators will be notified by system events when the approximate one-year life expectancy is reached.



WARNING!

1. The BBU is hot-swappable and can be independently swapped from the controller. However, the BBU is installed into a metal bracket on the controller module. When the controller is removed, the BBU is also removed.
 2. It is recommended to remove the BBU before handling the controller because once a controller is removed from chassis, BBU will discharge to support the cache memory. If you replace a DIMM module with supplied voltage, damage may occur.
 3. If necessary, replace a DIMM **1 minute** after the BBU is removed.
-

5.2.2 Notes on Controller Maintenance

- f Re-using the DIMM module removed from a failed controller is not recommended unless you have a similar RAID system to test its integrity.
- f When replacing the controller module, you must remember that the controller board is one of the most sensitive components in the subsystem. All previously stipulated safety precautions (see **Chapter 2**) must be strictly adhered to. Failure to adhere to these precautions can result in permanent damage, resulting in timely delays.

5.2.3 Removing the Controller Module

To remove the controller module:

- Step 1.** Prepare a clean, static-free work pad or container to place the controller that will be removed from the chassis.

(Step 2 and Step 3 are for the single-controller system. Skip them if you are replacing a controller in the FALCON iSCSI)

- Step 2.** **Make sure there is no data access to the subsystem to avoid losing data.** Stop all I/O accesses to the subsystem and make sure all cached writes have been distributed to disk drives.
- Step 3.** **Power off the subsystem.** Power off the subsystem in the cruiway bed in **Chapter 4**. Be sure to flush all cached data des before powering off the subsystem. If it is not possible to do this **turn off** both PSU modules and disconnect the power cords.
- Step 4.** **Disconnect all cables** that are connected to the controller module you wish to replace. These include the Ethernet cables connected to the network, and any cable connected to the RS-232C audio jack connector.
- Step 5.** Remove the BBU module if one has been installed. Loosen the BBU module' ws and then retrieve it from the retention scre chassis.

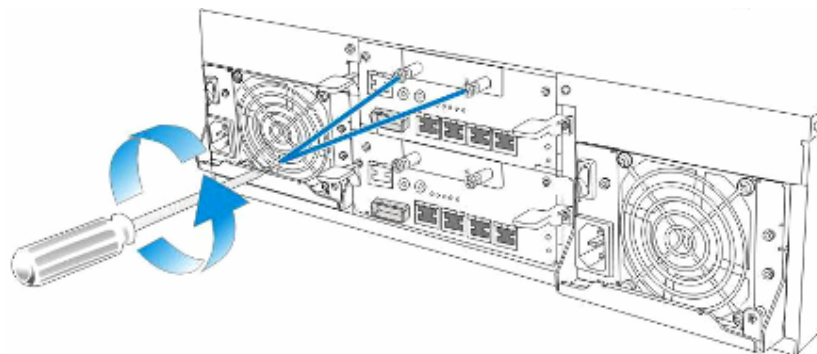


Figure 5-1: Loosening BBU Retention Screws

- Step 6.** Disconnect all cables from the controller module. These include the cables connecting to host, and any cables necting the o COM ports.
- Step 7.** **Loosen the retention screws from controller.** Use a medium-siz Phillips screwdrivee to remove the screws underneath each of the ejection levers. Keep the screws for future use.

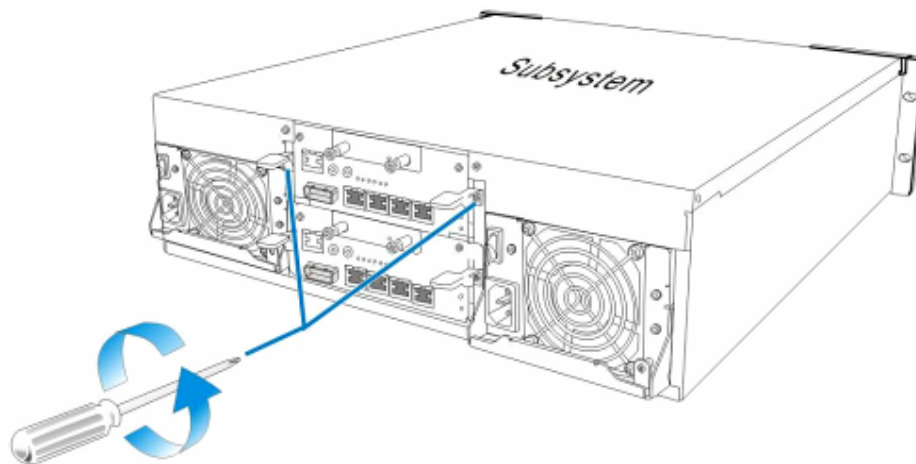


Figure 5-2: Loosening Controller Retention Screws

- Step 8.** **Remove the controller module** by pressing down the two ejection levers. The controller will automatically be eased out of the module bay. Gently pull the controller module out of the subsystem with one hand underneath to support the weight of the module.

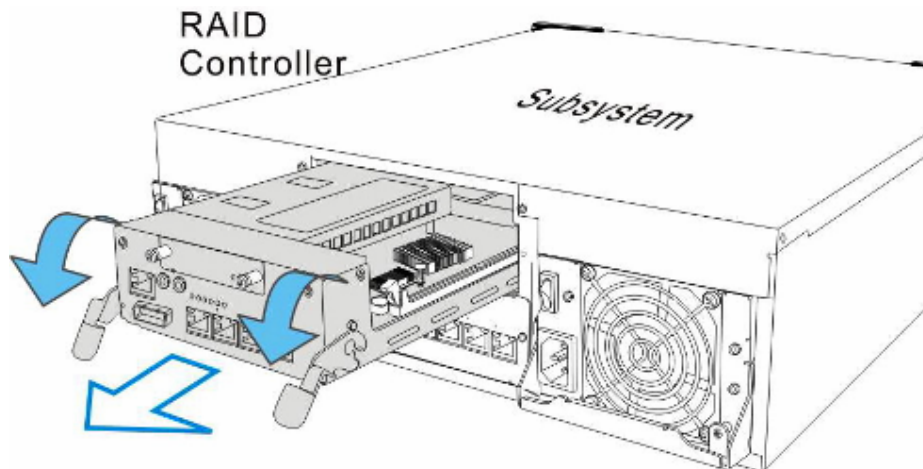


Figure 5-3: Removing the Controller Module

5.2.4 Replacing the Controller Module

If the controller module has failed, replace a failed controller with a replacement from your vendor:

- Step 1.** **Remove the failed controller.** (See Section 5.2.3)
- Step 2.** **Install a DIMM module on the replacement controller, if it does not come with a DIMM.** (See Section 5.3)
- Step 3.** **Insert the controller module.** Align the controller module with the controller module bay at the rear of the subsystem, making

sure that the levers are down. Gently slide the controller module in.

Step 4. Secure the connection. When the controller is reaching the end and you feel the contact resistance, use slightly more force to mate the controller with backplane connectors. When the controller is almost fully inserted, use the ejection levers to secure the controller. The levers help ensure that the back-end connectors are properly mated.

Step 5. Fasten the hand screws. Once fully inserted, secure the controller module to the chassis by fastening the retention screws through the holes underneath the ejection lever.

Step 6. Re-attach all the cables that you previously removed. These include the cables that connect to the local network or iSCSI initiators that were previously attached to the iSCSI ports, and any cable that was attached to the RS-232C audio jack connector.

Step 7. 7-1. **Power up** the subsystem if using a single-controller subsystem.

7-2. With a redundant-controller subsystem, RAID controllers should spend a short while negotiating and then deliver a “Redundant Controller Restored” message.

You can check for this message in the LCD screen, GUI manager, or firmware text-based utility. When the replacement controller is successfully brought online, its status Ready LED should light green on its faceplate.

5.3. Replacing or Upgrading Memory Modules

5.3.1 Memory Module Installation Overview

f The subsystem comes with a pre-installed 512MB (or above) DDR RAM DIMM module. The controller supports a memory module up to 2GB in size. If DDR RAM DIMM modules with a different size need to be used or the original memory module is damaged in some way, the pre-installed module can be removed and a replacement installed. Replacement and installation instructions are described fully below.

f A DIMM socket is located on the controller main circuit board. The controller board is a sensitive component and must be treated with care.

**WARNING!**

1. The controller board in the controller module is a sensitive item. Please ensure that all anti-static precautions stipulated above are strictly adhered to. Only qualified engineers should replace the DIMM module.
2. There is a “1GB” parameter threshold for NVRAM defaults in RAID’s disk array firmware. The 1GB threshold determines whether your RAID supports a standard or a large number of logical configurations by the size of cache memory.

The supported numbers by different DIMM sizes are shown below:

Feature	Default Value	
	<1GB DIMM	> 1GB DIMM
64-bit LBA Support (>2TB)	Yes	Yes
Number of LDs	16 (Max.)	32 (Max.)
Number of LVs	8 (Max.)	16 (Max.)
Number of Partitions per LD	16 (Max.)	64 (Max.)
Number of LUNs per Channel ID	8 (32 Max.)	8 (32 Max.)
Number of LUNs	128 (Max.)	1024 (Max.)
Optimization Mode	Sequential I/O	
Caching Mode (Default)	Write-Back	
Stripe size (Optimization for Sequential I/Os-RAID 5)	128KB	
Auto-assign Global Spare	Disable	
Max. LD capacity (Optimization for Sequential I/Os) No.	64TB (Max.)	
of Media Scan Task Schedules	16 (Max.)	
Max. No. of members per DIMM size (RAID5)	128 drives max./512MB	

This parameter threshold, however, can cause problems if users upgrade DIMM modules to a larger size, especially when combining two RAID controllers, without knowing their NVRAM defaults. The fault can also occur when replacing a faulty controller in a redundant-controller configuration.

Fault Scenarios:

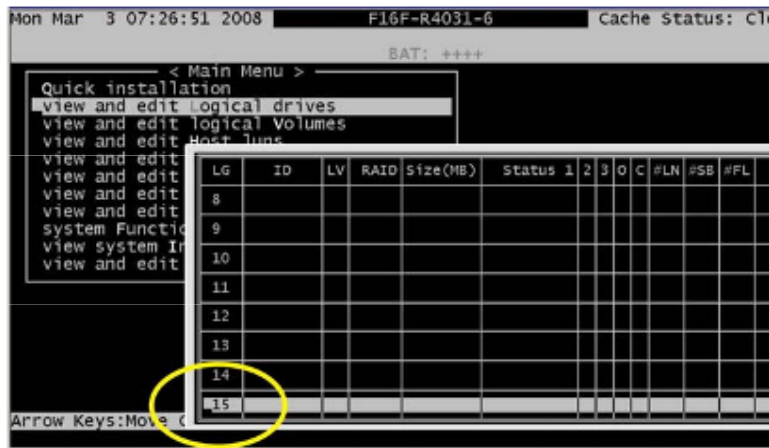
1. Field-side Upgrade:
 - 1-1. Customers upgrade controller DIMM modules, e.g., from 512MB to 1GB.
 - 1-2. Combine controllers into a redundant configuration. One retains the “512MB” defaults, while the other the “≥ 1GB” defaults.
2. Replacing a Failed Controller:
 - 2-1. Branch office acquires a replacement controller and upgrades its memory to the size of surviving controller.
 - 2-2. Though with the same memory size, the replacement still retains the incongruous defaults.

The RAID system will report a “Redundant Controller Failure” event,

and the controllers will not work coherently.

Remedy:

- **Restore firmware defaults** after installing/changing the DIMM module. You can either use the Restore Default button or the LCD keypad panel.
- The easiest way to check the type of firmware defaults is through the “View and Edit Logical Drives” menu.



Work Procedures:

Case 1: Upgrade memory in a single-controller system (512MB to 1/2GB)

- 1-1. Shut down host computer(s).
- 1-2. Power OFF the RAID system.
- 1-3. Remove the RAID controller and replace its memory with a 1GB or 2GB DIMM.
- 1-4. Restore firmware defaults using the Restore Default button or the LCD keypad panel.
- 1-5. Power ON the RAID system and check in “Main Menu” -> “View and Edit Logical Drives” to see whether the supported number of LD has become 32.
- 1-6. Power on host computer(s).

Case 2: Upgrade memory in a Redundant-controller system (512MB to 1/2GB)

- 2-1. Shut down host computer(s).
- 2-2. Power OFF the RAID system.
- 2-3. Remove the RAID controllers and replace their memory with a 1GB or 2GB DIMM.
- 2-4. Restore firmware defaults using the Restore Default button or the LCD keypad panel. You should restore controller defaults each at a time by removing a controller from chassis.
- 2-5. Power ON the RAID system and check in “Main Menu” -> “View and Edit Logical Drives” to see whether the supported number of LD has become 32.

2-6. Power on host computer(s).

Case 3: Replacing a failed controller in a redundant-controller RAID system equipped with 1G/2G size cache memory.

3-1. Check through the firmware configuration utility -> "Main Menu" -> "View and Edit Logical Drives" to see whether the supported number of LD is 32. If the screen shows 32 logical drive indexes, then the firmware running on the surviving controller supports the "≥ 1GB" defaults.

NOTE: If the firmware screen shows 16 indexes, you may refer to the Case 2 procedure if you prefer enlarging the number of logical configurations.

3-2. Install a 1G or 2G memory (size identical to that on the surviving controller) to the replacement controller.

3-3. Restore the replacement's defaults using the Restore Default button or the LCD keypad panel. (See Appendices for details) You should use another RAID system to restore the defaults on the replacement controller.

3-4. Replace the failed controller with the replacement. The replacement should be brought online after a short while.

5.3.2 Selecting the Memory Modules

If the memory module on the controller module is going to be replaced, the following factors must be considered when purchasing replacement DIMM modules:

- f **Purchasing a DIMM module:** To avoid the compatibility issues, it is recommended to contact RAID or your subsystem vendor for an updated list of compatible DIMM modules. We provide tested modules from reliable vendors with reliable chips.
- f **DDR RAM DIMM modules supported:** The subsystem supports 184-pin, registered, ECC-capable DDR RAM DIMM modules with memory capacities ranging from 512MB to 2GB.
- f **Installation considerations:** When installing the DIMM module, it is necessary to remove the controller module. The controller board is more susceptible to damage than other components and must therefore be handled with extreme care. ALL anti-static precautions specified in **Section 2.3** must be strictly adhered to.
- f **Secure installation:** When replacing the DIMM module, make sure that the new DIMM module is firmly in place prior to installing the controller module. If the DIMM module is not firmly in place, the subsystem will not

run and the controller will need to be removed and the DIMM module correctly installed.

5.3.3 DIMM Module Installation



WARNING!

The pre-installed modules must be removed prior to installing new modules. Do this with care. Sensitive components can be damaged during the process.

- Step 1.** Prepare an anti-static work pad or container for placing a removed module. Use of an ESD grounding strap is highly recommended.
- Step 2.** Remove the BBU module, if installed. Carefully place the module for it contains Li-ion batteries. Do not drop it to the floor or place it near any heat source or fire.
- Step 3.** **Remove the controller module.**
- Step 4.** **Remove the previously installed DIMM module from the DIMM socket.** To do this, push the white module clips on either side of the DIMM socket down. By doing this, the DIMM will be ejected from the DIMM socket.

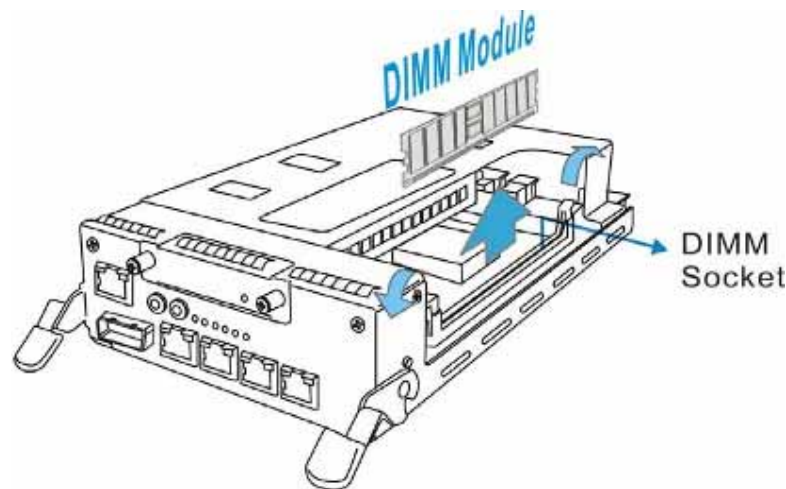


Figure 5-4: Removing a DIMM Module

- Step 5.** **Insert the replacement module into the DIMM socket.** Make sure the white clips of the DIMM socket are in the open positions. Align the DIMM module with the DIMM socket by checking its “keyed” position. Once aligned, gently and firmly push the DIMM module into the socket. The white clips on the sides of the socket will close automatically and secure the DIMM module into the socket.

Step 6. Reinstall the controller module. After the DIMM module has been properly installed, install the RAID controller. To do this, align the controller module with the controller module bay. Then gently push the controller module into the controller bay. Carefully push the controller until you feel the contact when the board edge connectors are being mated to the backplane. Do not use force. If unusual contact resistance is felt, try it again. Use the ejection levers to secure it into the chassis when the controller is almost fully inserted.

When the controller is inserted with the levers at its lowest position, notches on the levers should properly clinch to the round anchor pins on the interior walls of module bay. You may then pull the lever upward to secure the controller into module bay.

Step 7. Next secure the controller module into the subsystem by fastening the screws through holes underneath each ejection lever.

5.4. Replacing a Faulty BBU

The BBU can sustain cache memory in the event of a power failure or in the unlikely event of failing both PSUs. The BBU provides additional data security and helps minimize the chance of losing data due to power outages.

A BBU consists of a metal bracket, battery cell pack, and a PCB board that connects to the controller module. Each BBU is secured to the subsystem using retention screws. Please read the BBU handling precautions below before proceeding with the replacement procedure.

Fault Conditions:

A BBU failure can result from the following:

1. A BBU has lost its ability to hold electrical charge. This may be the case after the battery cells have been recharged for many times regardless of how long the module has been used. Therefore, a stable power source is important for system operation.
2. The charger circuitry implemented with the controller has failed.

There are other conditions that might trigger the BBU fault events and trigger the BBU fault LED:

1. The temperature sensor embedded with the subsystem's charger circuit reports a temperature reading exceeding the preset threshold. The charger circuits will enter a low-power and self-protection state.

2. A BBU module has been charged for over twelve (12) hours. A timer is embedded with the charger. When this occurs, the charger will enter a timer fault state. The fault condition usually occurs with a brand new BBU or with a totally discharged BBU. Charging will resume automatically if you remove and re-install the BBU module.

5.4.1 BBU Warnings and Precautions

- f Install or replace the BBU with BBUs supplied by your Falcon vendors only. Use of battery cells provided otherwise will void our warranty.
- f Always dispose of a replaced battery in an ecologically responsible manner. Dispose of used BBUs at authorized battery disposal sites only.
- f Do not use nor leave the BBU near a heat source. Heat can melt the insulation and damage other safety features of battery cells, possibly will cause acid leak and result in flames or explosion.
- f Do not immerse the BBU in water nor allow it to get wet. Its protective features can be damaged. Abnormal chemical reactions may occur, possibly cause functional defects, acid leak, and other hazardous results.
- f Do not disassemble or modify the BBU. If disassembled, the BBU could leak acid, overheat, emit smoke, burst and/or ignite.
- f Do not pierce the BBU with a sharp object, strike it with a hammer, step on it, or throw it. These actions could damage or deform it and internal short-circuiting can occur, possibly cause functional defects, acid leak, and other hazardous results.
- f If a BBU leaks, gives off a bad odor, generates heat, becomes discolored or deformed, or in any way appears abnormal during use, recharging or storage, immediately remove it from the subsystem and stop using it. If this is discovered when you first use the BBU, return it to RAID or your subsystem vendor.

5.4.2 Replacing a Faulty BBU

To replace the BBU, please follow these steps:

- Step 1. Remove the faulty BBU from the chassis.** The BBU module is secured to the chassis with two (2) screws. Loosen the retention screws on the BBU faceplate, then pull out the BBU. (See **Figure 5-5**)

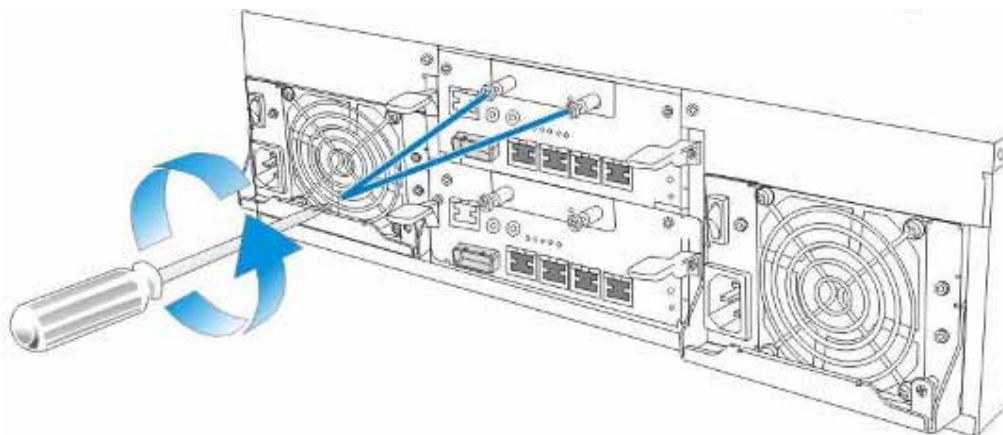


Figure 5-5: Remove the Retention Screws from BBU Faceplate

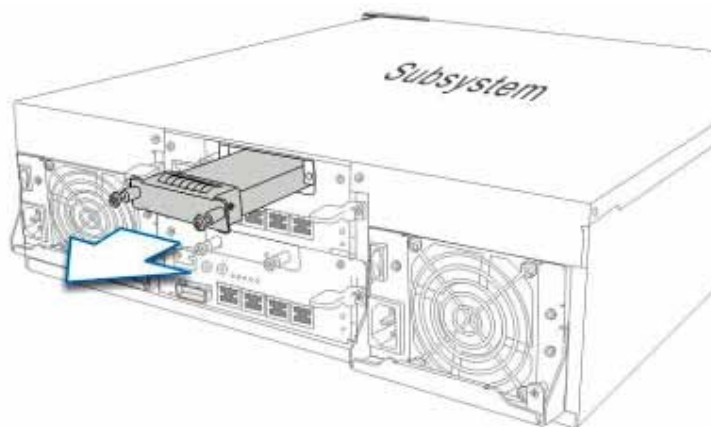


Figure 5-6: Remove the BBU Module

- Step 2.** **Install the replacement BBU.** Align the BBU module with the empty slot, and then gently push the BBU module into the slot.
- Step 3.** **Secure the BBU module to the enclosure.** Tighten the two (2) retention screws as shown above using a Phillips screwdriver.
- Step 4.** **Reset the subsystem.** Find appropriate time to reset the subsystem for the system firmware to recognize the replacement module. After reset, the BBU LED will start flashing to indicate that the BBU is being charged. When the BBU is fully charged, the LED will be off.



NOTE:

1. A new or replacement BBU takes approximately twelve (12) hours to charge to its full capacity. Reset the subsystem whenever a BBU is replaced or added in order for the replacement module to take effect.
2. The life expectancy of a BBU is more than one year. However, it is considered a safe procedure to replace the BBU every year. Follow

the procedures above to replace a used BBU in order to maintain the fault tolerance feature.

3. The chance of BBU charger failure is comparatively low. If the cause of a failure cannot be determined even after a BBU module is replaced, contact your system vendor for a replacement controller and return the controller module through RAID's standard RMA procedure.
-

5.5. Replacing a Faulty PSU

5.5.1 Notes on PSU Module Maintenance

- f **Two (1+1) redundant PSU modules:** The subsystem comes with two fully redundant, hot-swappable PSU modules. These modules are located at the rear section of the subsystem.
- f **PSU canister:** Each PSU module is housed in a robust steel canister, with the power supply converter unit in the front and two serially-aligned cooling fans in the rear section. When the PSU is removed from the chassis, the cooling module is also removed.
- f **Printed text on PSU handle:** Before you insert a replacement PSU, make sure that the printed text on the PSU handle matches the printed text on a partner PSU. Double-check to avoid using a PSU of a different Falcon model. They may not be pin-compatible.

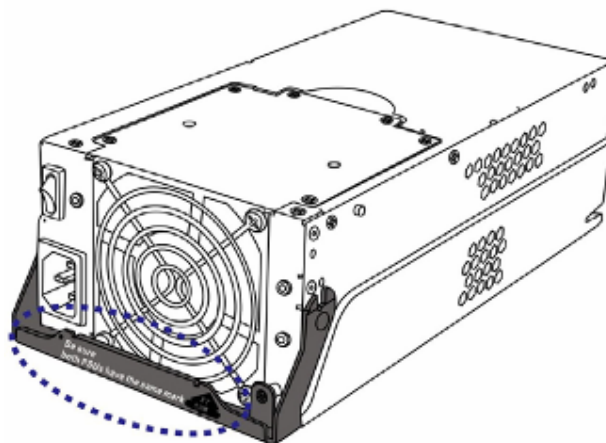


Figure 5-7: Printed Text on PSU Handle

- f **Immediate replacement:** When a PSU fails, it should ideally be replaced immediately. Do not remove the PSU module unless a replacement is readily available. Removing a PSU without a replacement will cause severe disruptions to the internal airflow and the subsystem

will overheat, possibly causing irreparable damage to some of the subsystem components.

**WARNING!**

Although the subsystem can operate using a single PSU module, it is not advisable to run the Falcon subsystem with a single PSU module for an extended period of time.

5.5.2 Replacing the PSU Module

**WARNING!**

Before you insert a replacement PSU, be sure that it has the same warning label on its extraction handle as that shown on the lever of a remaining PSU. Double-check to avoid mixing a similar yet incompatible PSU of another Falcon model.

To replace a PSU, please follow these steps:

- Step 1.** **Power off the PSU.** The power switch is located on each PSU's rear-facing panel. (See **Figure 5-8**)
- Step 2.** **Disconnect the power cord** that connects the PSU to the main power source.
- Step 3.** **Remove the retention screw** that secures the extraction handle to the chassis.

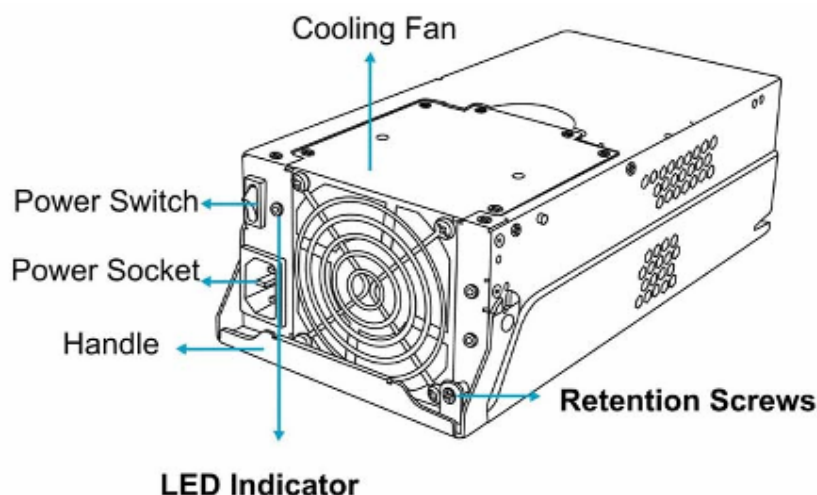


Figure 5-8: PSU Parts Identification

- Step 4.** **Remove the PSU module** by pulling the extraction handle upwards. The extraction handle should gracefully disconnect

the PSU from the backplane connectors. Once dislodged, gently pull the PSU module out of the subsystem. If the subsystem is mounted in a rackmount rack, use another hand to support its weight while removing the module. (See **Figure 5-9**)

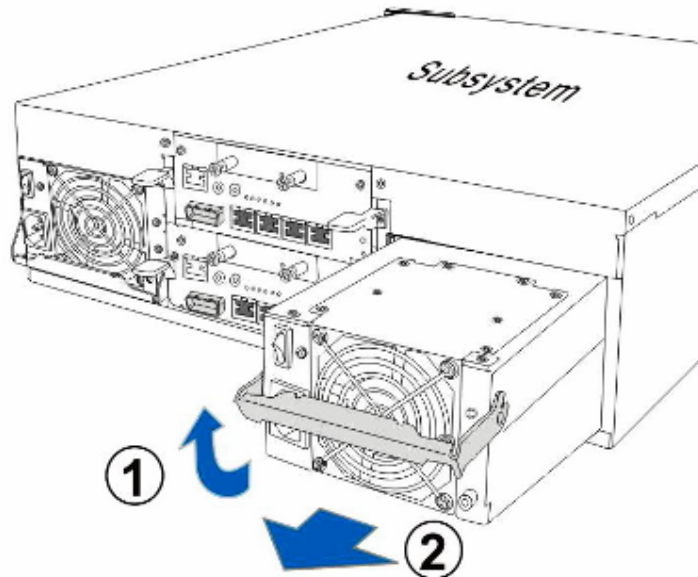


Figure 5-9: Removing the PSU Module



WARNING!

1. When a PSU is removed from the chassis, the cooling module is also removed from the chassis.
2. It is recommended that the replacement procedure is completed in less than five (5) minutes to prevent the subsystem from overheating.

Step 5. **Install the replacement module.** Make sure the extraction handle is held at its up-most position so that the saddle notches on the sides of the handle can snap onto the metal anchor pins along the interior walls of the PSU slot. Push the PSU into chassis, and when you feel the contact resistance, push the handle downward to secure the module.

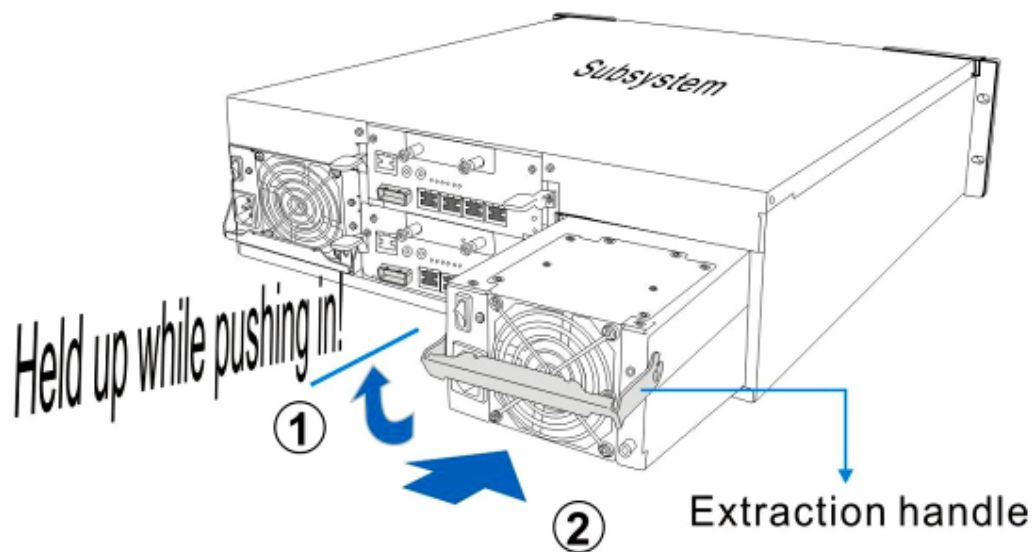


Figure 5-10: Installing the Replacement PSU

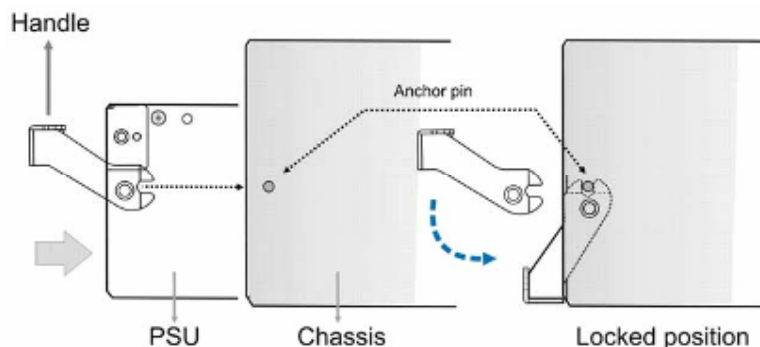


Figure 5-11: Securing PSU Using the Extraction Handle

- Step 6.** **Secure the PSU to the subsystem** by fastening the retention screw through the PSU ejection handle.
- Step 7.** **Replace the power cord** that connects the PSU module to the mains.
- Step 8.** **Power on the PSU module.**

5.6. Cooling Module Maintenance

5.6.1 Notes on Cooling Module Maintenance

- f* **Redundant cooling modules:** The subsystem is equipped with four (4) cooling fans, two (2) within each PSU and cooling fan combo module. These cooling modules control the internal operating temperature of the subsystem and therefore their working integrity should be maintained at all times.

Although the cooling modules are fully redundant, it is not advisable to run the Falcon subsystem with fans in a single PSU module for an extended period of time. If the cooling fans in the only remaining PSU module fail, the subsystem will quickly overheat.

- f **Detecting a failed cooling module:** If a cooling module fails, the LEDs located at the back of the PSU module, an audible alarm, the firmware, and the StorageWatch manager software can notify you.
- f **Replacing a cooling module:** Once you are notified that a cooling module has failed, it should be replaced as soon as possible. A failed cooling module should only be removed from the subsystem when you have a replacement module immediately available.

5.6.2 Replacing a Cooling Module

If one of the cooling modules fails, it must be replaced as soon as possible. The cooling module is secured to the PSU module with the six (6) screws from the top. To replace the cooling module, follow the steps below:



WARNING!

The fan replacement process should be completed within five (5) minutes. If the process takes too long, the accumulated heat can damage the subsystem.

- Step 1.** **To remove the cooling module,** remove the PSU module first. Please follow the PSU removal process listed in the previous discussion.
- Step 2.** **Use a medium-size Phillips screwdriver to remove the six screws from the top of the PSU module.**

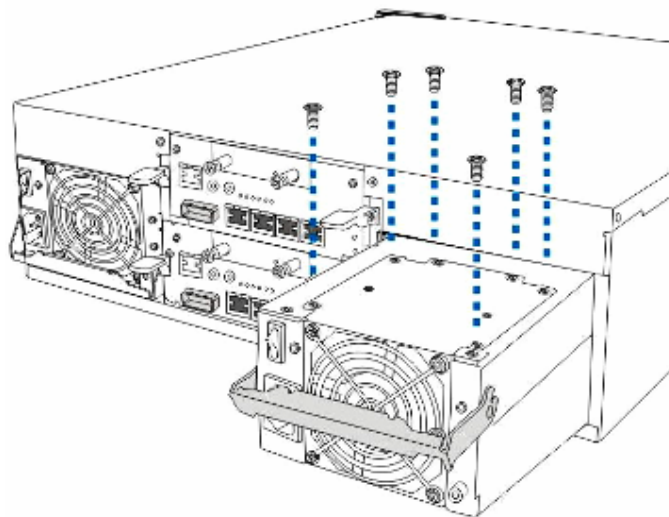


Figure 5-12: Removing a Cooling Module

Step 3. Remove the cooling fan assembly by the following steps:

- Step 3-1. Use your thumb and middle fingers to seize the cooling assembly, your thumb by the upper edge of the fan guard and your middle finger at the hemispheric indent.
- Step 3-2 Tilt the fan a little bit and remove the fan assembly with a precisely vertical motion.

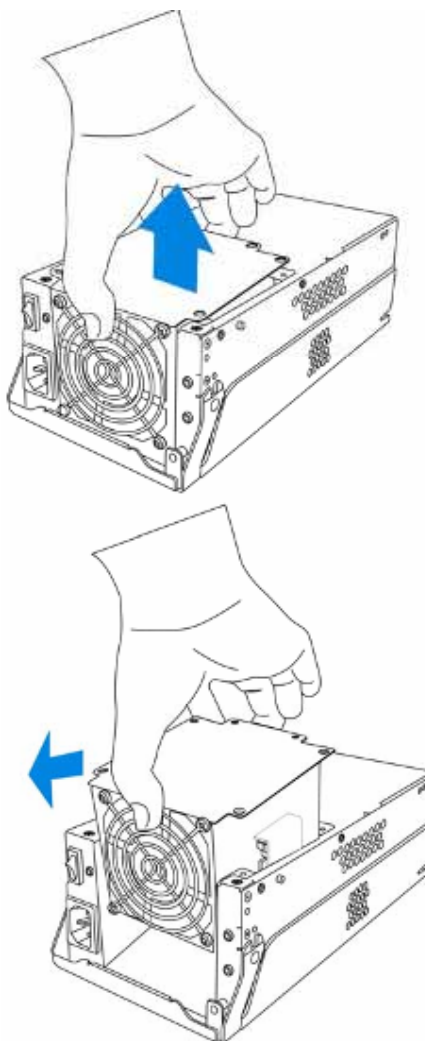


Figure 5-13: Removing a Cooling Module

Step 4. Install the replacement module by aligning it with the module bay on the PSU module and gently lowering it into. The fan outlet should be aligned with the PSU faceplate and that the side with screw holes should be facing up.

Do this with a precisely vertical motion so that the cooling module's connector can correctly mate with the connector in the module bay.

- Step 5.** **Secure the module** by fastening the screws you previously removed.
- Step 6.** **Reinstall the PSU module into chassis.** When powered on, check if the cooling fan LEDs are lit. If not, that means your cooling fans are operating properly.

5.7. Replacing a Hard Drive

5.7.1 Hard Drive Maintenance Overview

- **Hot-swappable drive trays:** The drive trays are all hot-swappable. A disk drive failure can be corrected online.
- **Handles:** If the failed hard drive is behind either the left or right front handle, unfold the handles to open the front access to the drive trays.

- Step 1.** **Open the front bezel:** Once the front bezel on the drive tray has been opened, the drive tray must be removed from the subsystem.



CAUTION!

Failure to remove a healthy drive from the subsystem after the front bezel has been opened can cause data errors.

- Step 2.** **Slowly remove a faulty drive:** When removing a drive tray from the subsystem, **pull the drive tray out only about one inch and then wait for at least 30 seconds for the hard drive motor to spin down before taking it out completely.** Any impact to the hard drive while the drive motor is spinning can damage the hard drive.

There are situations that healthy drives can be removed. In operations such as Copying & Replacing member drives with drives of larger capacity, you may need the replaced disk drives in other installations.

- Step 3.** **Keep a replacement on hand:** If a hard drive has failed, make sure you have a replacement drive readily available before removing the failed drive from the subsystem. Do not leave the drive bay open for an extended period of time or the normalized airflow will be disrupted and system components will overheat damaging the system.

5.7.2 Replacing a Hard Drive

To replace a hard drive, please follow these steps:



WARNING!

Hard drives are fragile; therefore, always handle them with extreme care.

- f Do not drop the hard drive.
- f Always be slow, gentle, and careful when handling a hard drive.
- f Handle a hard drive only by the edges of its metal cover, and avoid touching its circuits part and interface connectors.

Step 1. Identify the location of the drive tray that contains a hard drive indicated as faulty. You may use firmware utility or StorageWatch software to locate a faulty drive. The drive tray LED should also light red.

Step 2. Use a flatblade screwdriver to turn the rotary bezel lock to the **unlocked position**, i.e., the groove on its face is in a horizontal orientation.

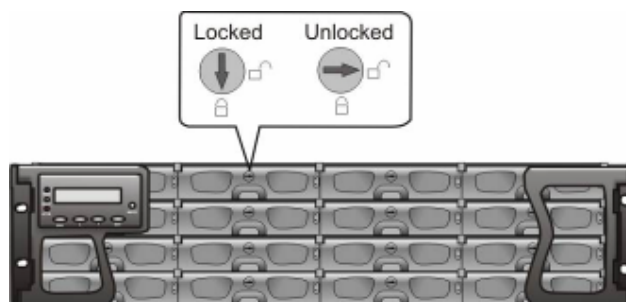


Figure 5-14: Opening the Front Flap

Step 3. Open the tray bezel by pushing the release button. The front bezel will automatically swing open.

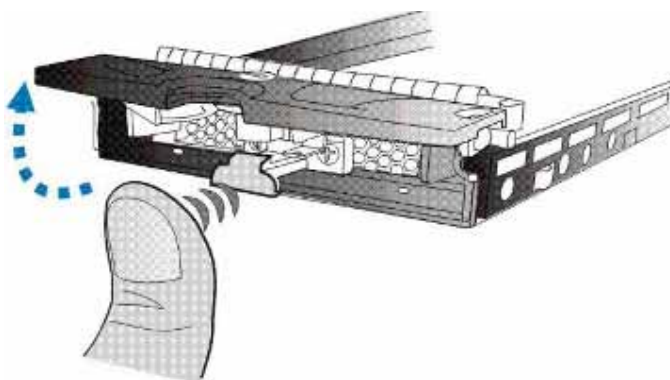


Figure 5-15: Opening the Drive Tray Front Bezel

Step 4. Remove the drive tray by pulling it one inch away from the drive bay. Wait for at least 30 seconds for the disk drive to

spin down (if the disk drive is removed for a different purpose, e.g., cloning the members of a logical drive or **Copy & Replace**), and then gently and carefully withdraw the drive tray from the chassis.

- Step 5.** **Remove the four (4) retention screws** that secure the hard drive from the sides of the drive tray (two on each side.)

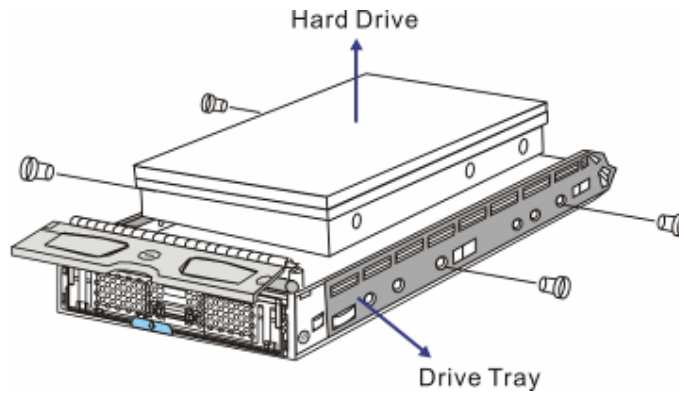


Figure 5-16: Loosening the Hard Drive Screws

- Step 6.** **Install the replacement hard drive.** Please refer to the complete hard drive installation procedures in **Section 2.6**.

Appendix A

Specifications

A.1. Technical Specifications

Environmental Specifications	
Humidity	5 to 95% (non condensing – operating and non-operating)
Temperature	Operating: 0° to 40°C (35°C if BBU is applied) Non-operating: -40° to 60°C
Altitude	Operating: Sea level to 12,000ft Packaged: Sea level to 40,000ft

Power Requirements	
Input Voltage	100VAC @ 9A 240VAC @ 4.5A with PFC (auto-switching)
Frequency	47 to 63Hz
Power Consumption	530W

Dimensions		
	With Forearm Handles (Not including rear-end protrusions, e.g., levers)	Without Forearm Handles
Height	131mm (5.2 inches)	130mm (5.1 inches)
Width	482.6mm (19 inches)	445mm (17.5 inches)
Length	504.3mm (19.8 inches)	486.7mm (19.2 inches)

System Weight	
Net Weight	28.5kg (62.7 pounds)
Gross Weight	30.5kg (67.1 pounds)

Certifications

IEC 60068-2
MIL-STD-810E/883E1
STA
ASTM-D3332
IPC-TM-650
IEC 1000-4
IEC 1000-3-2, IEC 1000-3-3
ISO 7779/3744
RoHS
Microsfot WHQL-Windows Server 2003

EMC

CE
EN 55022: 2006
EN 61000-3-2: 2006
EN 61000-3-3: A1: 2001/A2: 2005
EN 55024: 1998/A1: 2001/A2: 2003
FCC (FCC Part 15, subpart B)
BSMI (CNS 13438)

Safety

UL (60950-1: 2006)
BSMI
CNS 14336: 1993
IEC 60950-1, First Edition
CB IEC 60950-1: 2001
GOST-R: GOST 60950

Shock**Half-sine**

Operating: 5G peak, 11ms duration
Non-operating: 15G, 11ms duration

Vibration**Operating**

0.5oct/min, 5 to 500Hz, sinewave, 0.2G

Non-operating

0.5oct/min, 5 to 500Hz, sinewave, 1.0G

- Various tests have been conducted according to industry standards. Please contact your sales representatives for individual test reports.

Warning Alarms
• Audible alarms • System LEDs • Event notification via the StorageWatch Manager (LAN broadcast, email, fax, MSN, SMS, and SNMP traps) and RS-232C terminal screen

A.2. Controller Specifications

A.2.1 Configuration

Specification	
RAID Levels	0, 1(0 + 1), 3, 5, 6, 10, 30, 50, 60, JBOD, and non-RAID
Host O/S Compatibility	disk spanning Host O/S independent; also dependent on iSCSI offload utilities and hardware
Host Interface	RJ-45 Gigabit Ethernet
Host Channels	4 pre-configured host channels
Drive Interface	Supports up to 16 channels of 3Gbps SAS or SATA-II
Drive Channels	All drive channels are pre-configured and cannot be changed
Cache Mode	Write-through, write-back, and adaptive write policy
Cache Memory	Pre-installed 512MB (or above) DDR RAM DIMM with/without ECC, registered; in one DIMM socket
Number of LUN's	Up to 32 per host ID; depends on DIMM size
Multiple Target IDs/Host Channel	Yes
Firmware on Flash Memory	Yes

A.2.2 Architecture

Specification	
CPU	PowerPC 750GL
Gigabit Ethernet Chip	Intel 82546 x 2 (4 channels)
Controllers	Intel 82546 x 2 (4 channels)
DIMM Slot	One 184-pin DDR DIMM module
ASIC	RAID 64-bit chipset (ASIC400)
Flash ROM	64Mbit (8MB)

NVRAM	32KB with RTC (with the Embedded RAIDWatch utility)
Hardware XOR	Yes
Real-time Clock	For event messages with time record and task scheduling

A.3. Power Supply Specifications

Specification	
Nominal Power	530W with active PFC
DC Output	12.0V: 32A (Max.) 5.0V: 32A (Max.) 3.3V: 30A (Max.)
Input Frequency	47 to 63Hz
AC Input	100VAC @ 9A or 240VAC @ 4.5A with PFC
Power Factor Correction	Yes
Hold-up Time	At least 20ms at 115/230VAC full load after a loss of AC input
Over-temperature Protection	Auto shutdown when lost cooling or exceeded ambient temperature; over-voltage protection is also available.
Cooling Fans	No fans specific for PSU; heated air is drawn by the cooling fan module fixed in the rear section of PSU.

A.4. Cooling Module Specifications

Specification	
Speed	High or low rotation speed controlled by firmware proactive mechanisms
Max. Air Flow (each module)	High speed: 90 CFM Low speed: 70.7 CFM
Input Power	13.2W max.
Input Current	1.1A max.
Rated Voltage	DC 12V
Temperature	Operating: -10 to +70°C Storage: -30 to +70°C
Acoustic Noise	High speed: 51dB Max. Low speed: 46dB Max.

A.5. RAID Management

Specification	
Configuration	- Text-based firmware-embedded utility over RS-232C through the included audio jack-to-DB-9 serial cable - LCD keypad panel - The StorageWatch Manager program using the management port (10/100BaseT)
Performance Monitoring	Yes
Remote Control and Monitoring	Yes
Event Broadcast/Alert	Yes (via StorageWatch sub-modules, the Notification Manager utility, or the firmware-embedded browser-based RAIDWatch)
Hardware Connection	over Ethernet or RS-232C
Configuration on Disk	Configuration data stored on disks for logical drive assemblies to exist after controller replacement; basic settings, e.g., channel mode settings, are stored on NVRAM
Failure Indicator	Via audible alarm, LCD panel, StorageWatch Manager session, or terminal emulation

A.6. Fault Tolerance Management

Specification	
Drive S.M.A.R.T. support	Yes, with user-configurable detect-only, clone-and-replace, and perpetual-clone options.
Battery Back-up Option	Yes
Sensors and Module Presence detection through an I ² C serial bus.	Yes
Automatic Drive Failure Detection	Yes
Automatic Rebuild on Spare Drives	Yes
Regenerate Logical Drive Parity	Yes
Bad Block Reassignment	Yes
Automatic Rebuild upon Failed Drive Replacement	Yes
Manual Clone of Suspected Failed Drive	Yes
Concurrent Rebuild on Multiple Drives in a RAID (0 + 1) or RAID6 Logical Drive	Yes

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Appendix B

Pinouts

B.1 GbE Ethernet Port Pinouts (iSCSI Host Ports)

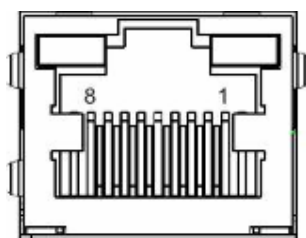


Figure B-1: GbE Ethernet Port

Automatic MDI/MDI-X Crossover: Crossover can be implemented internally at hub or switch or externally through twisted pair media.

Pin	Pin Name	Color Match
1	BI_DA+	Orange
2	BI_DA-	Orange/white
3	BI_DB+	Green
4	BI_DC+	Blue/white
5	BI_DC-	Blue
6	BI_DB-	Green/white
7	BI_DD+	Brown
8	BI_DD-	Brown/white

Table B-1: GbE Ethernet Port Pinouts

B.2 10/100BaseT Ethernet Port Pinouts (Management Port)

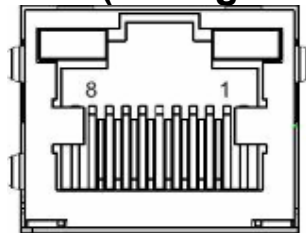


Figure B-2: 10/100BaseT Ethernet Port

Pin	Pin Name	Color Match
1	LAN_TXP	Orange
2	LAN_TXN	Orange/white
3	LAN_RXP	Green
4	N2	Blue/white
5	N2	Blue
6	LAN_RXN	Green/white
7	N1	Brown
8	N1	Brown/white

Table B-2: 10/100BaseT Ethernet Port Pinouts

B.3 STP Ethernet Cable (Optional Accessory)

P/N: IFT-9273CSTPCab-0030

This shielded twisted pair cable is an optional accessory item. More details are shown below:

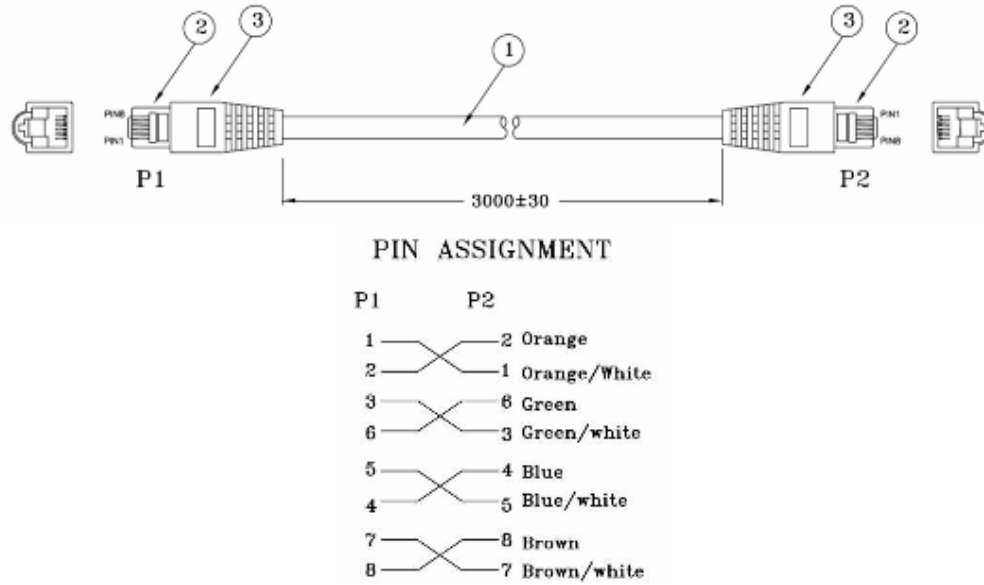
Description: SFTP CAT5E Ethernet cable.

Color: black.

Connector: 8 pin RJ45 (covered by metal shield)

8C plP

Cable type: round cable, #24AWG*4P braided wire OD: 6.2mm



metal shield – braided wire – metal shield

Figure B-3: STP Ethernet Cable Pinouts

B.4 COM1 Serial Port Cable

The 2-audio jacks to DB9 Y-cable connects the COM1 serial ports on the redundant RAID controllers for maintenance-free terminal emulation connection during controller failover/failback.

IFT-9270AYCab

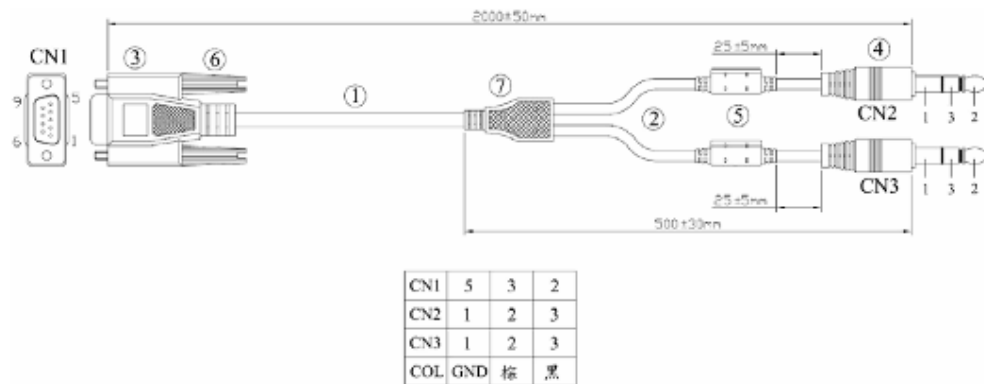


Figure B-4: COM1 Y-Cable

CN2 & CN3 Pin Number	Pin Name
1	GND
2	TXD
3	RXD

CN1 Pin Number	Pin Name
1	NC
2	RXD
3	GND
4	DTR (Shorted)
5	TXD
6	DSR (Shorted)
7	RTS (Shorted)
8	CTS (Shorted)
9	NC

Table B-3: COM1 Y-Cable CN1, CN2, and CN3 Pinout Definitions



NOTE:

The CN1 and CN2 connector pinouts of the single end-to-end cables are identical to the CN1 and CN2 pinouts of the Y-cables. This applies to both COM1 and COM2 cables.

B.5 COM2 Serial Port Cable to UPS

COM2 Cable: Use this optional, separately-purchased cable to connect the COM2 port to a UPS.

PN: IFT-9270CUPSYCab

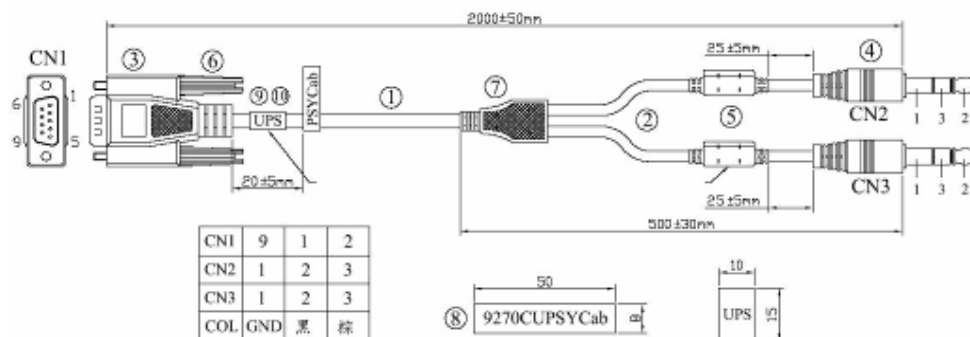


Figure B-5: COM2 Y-cable

CN2 & CN3 Pin Number	Pin Name
1	GND
2	TXD
3	RXD

CN1 Pin Number	Pin Name
1	TXD
2	RXD
3	NA
4	NA
5	NA
6	NA
7	NA
8	NA
9	GND

Table B-4: COM2 Adapter Cable CN1, CN2, and CN3 Pinout Definitions

B.6 SAS Expansion Port Pinouts

The Mini SAS host ports comply with SFF-8088 specification.

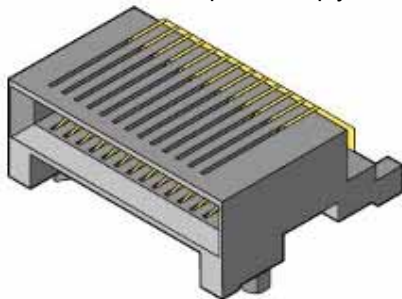


Figure B-6: Mini SAS SFF-8088 Connector

Pin	Description	Pin	Description
A1	GND	B1	GND
A2	RX0+	B2	TX0+
A3	RX0-	B3	TX0-
A4	GND	B4	GND
A5	RX1+	B5	TX1+
A6	RX1-	B6	TX1-
A7	GND	B7	GND
A8	RX2+	B8	TX2+
A9	RX2-	B9	TX2-
A10	GND	B10	GND
A11	RX3+	B11	TX3+
A12	RX3-	B12	TX3-
A13	GND	B13	GND

Table B-5: SAS Expansion Port Pinout Definitions

B.7 IFT-9011 Null Modem

A null modem is used for wire-swap and is necessary for connecting COM1 CN2 to a PC serial port.

PN: IFT-9011

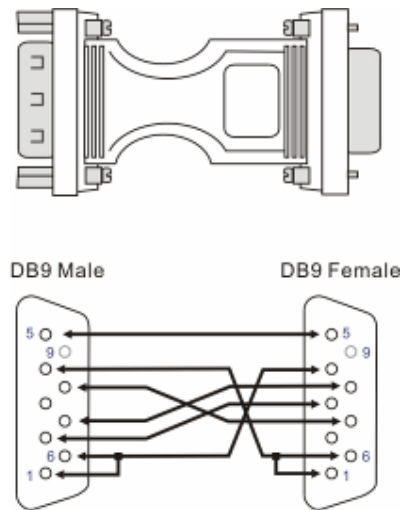


Figure B-7: Null Modem Pinouts

Swap pin 2 and pin 3
Swap pin 4 and pin 6
Swap pin 7 and pin 8

Table B-6: Null Modem Pinouts

B.8 Power

IEC-type receptacle. Unless specified otherwise, cable type will be determined by the shipped-to area.

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